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ANNEX

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THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

(WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE.")

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S., &c.

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THE CHEMICAL NEWS.

VOLUME XX.

EDITED BY WILLIAM CROOKES, F.R.S., &c.

No. 501.—FRIDAY, JULY 2, 1869.

THE FARADAY LECTURE,

DELIVERED BY

M. J. DUMAS,

Sénateur; Président de la Commission des Monnaies et Médailles; Member, and one of the Perpetual Secretaries, of the Institut; Inspecteur Général de l'Enseignement Supérieur; President de la Société d'Encouragement pour l'Industrie Nationale; Grand Croix de la Légion d'Honneur, &c., &c.

BEFORE THE

CHEMICAL SOCIETY OF LONDON,

IN THE

THEATRE OF THE ROYAL INSTITUTION,

THURSDAY, JUNE 17TH, 1869.

GENTLEMEN,—You have desired that the memory of Faraday should be handed down to posterity; you have summoned together men of science, all to celebrate, in a solemn manner, his great and beneficial labours; and, calling upon France to take the lead in this solemnity, you have chosen me to be his panegyrist, no doubt on account of the long and constant friendship with which I was honoured by Faraday.

I am the bearer of the acknowledgments of the scientific men of France, as well as my own. My country—I am proud to say it—can offer representatives of science much more worthy of your approbation; but I know no one, at least, who feels more intimately the sentiments of profound gratitude for the noble welcome which England has accorded for so long a time, nor do I know one who bears so sincere a veneration for Faraday.

The name of your illustrious fellow countryman is not one which any single nation can claim as its exclusive property; his labours and discoveries are as widely recognised in France, in Germany, and in America as in England. Faraday belongs to the whole world. There is not a spot on this earth to which civilisation has penetrated, that does not claim the right of partaking of the respect and gratitude you entertain for him.

Faraday was identified with the scientific movement of the first half of this century; he was one of its principal leaders, and drew in his train a whole host of thinkers, engineers, men of enterprise, and capitalists. Ever contemplating the chaste beauties of nature, and searching into her most hidden recesses, this disinterested philosopher, this deep thinker, scattered broadcast on his path the seeds of the most extraordinary and unheard-of results—such are the electric currents of Faraday that bear our messages, furrowing Europe and traversing the Atlantic—such are those lights, rivalling the sun in brilliancy, which shine forth from our principal lighthouses; and it is even to the gases which he liquefied that hot countries owe the luxury of ice.

In the pursuit of truth alone, he was able to satisfy, as if by accident, the boldest demand of a refined civilisation; and, devoted to the ideal, he sowed the seed of riches, not for himself, for he despised them, but for the profit of trade, which has gathered the fruit.

Faraday is the type of the most fortunate and most accomplished of the learned men of our age. His hand, in the execution of his conceptions, kept pace with his mind in designing them; he never wanted boldness when he undertook an experiment, never lacked resources to ensure success, and was full of discretion in interpreting results. His hardihood, which never halted when once he had undertaken a task, and his wariness, which felt its way carefully in adopting a received conclusion, will ever serve as models for the experimentalist.

The study of nature entirely puts aside conjecture, and places a guard on vague hypotheses; it begins with facts, ascends to laws, and raises itself, as far as the limits of man's intellect will permit, to the knowledge of causes, by the triple means of observation, experiment, and logical deduction. A long familiarity with the exact detail of phenomena can alone give to a man, as to Faraday, the right of being bold; he is, like Faraday, restrained when he has a thorough appreciation of the limits of man's knowledge. It is two centuries ago since Europe received this system of philosophy from Galileo and Newton, characterised at that epoch by the establishment of the Academy of Naturæ Curiosorum, in Germany, which represented the art of observation; in Italy, by the Academia del Cimento, the school of experimental science; and in England and France, by the Royal Society of London and by the Académie des Sciences de Paris, which adopted mathematical science as one of the means most conducive to the knowledge of truth in the domain which is accessible to us.

What an awakening for Europe! After two thousand years, she found herself in the same position to which she was raised by the profound intellect of India, and the acute genius of Greece, by Aristotle, Plato, Archimedes, and their emulators, from which, during those long ages, she was permitted to fall, whilst the work of the assimilation of races

was being carried on under the political influence of Rome.

What would have been the result if the learning of the Greeks, continuing its development from the third century before Christ to our own days, had pursued its triumphant march without hindrance? We do not know; no more than we can forecast the material resources of the human race after twenty centuries, nor to what heights the science of nature will have risen, should no social revolution create a breach in its tradition or retard its progress.

Greek art presents inimitable models; Greek philosophy has forestalled the modern schools in all their fearless opinions; and Greek science, not less prolific, paved the way which Europe has followed after long hesitation.

It is not difficult to connect Leucippus, a contemporary of Alexander the Great, who first clearly enunciated the philosophical doctrine of atoms, and the illustrious physicist of Manchester, Dalton, who, at the commencement of this century, founded, upon experiment, the atomic theory of modern chemists. Between these two points, so far removed, there is no intermediate link. Dalton is the son of Leucippus. Thus Cuvier, too, whose inventive genius was greater than that of Aristotle, was the sole inheritor of his spirit of order, his love of method, and his strength of judgment. In the same manner, we may ascend directly from Galileo and Newton, to Archimedes and Plato; the ideas of Faraday, too, on matter, atoms, force, and motion, were those of a Greek philosopher. The Romans did not receive this inheritance from the Greeks; given more to practical pursuits, they did not recognise the fact that these owed their progress to pure theory.

Truth is so beautiful that it deserves every effort a man can bestow to gain it; it is so fruitful that it carries along with it its own recompense. In placing before our mind the end, without occupying ourselves with particulars, we find the ordinary details of well-being and riches fall into their proper places.

Has not the atomic theory of Dalton, in assigning limits to phenomena, renewed the whole art of chemistry? Has Lavoisier's theory of combustion ever ceased to direct agriculture, the useful arts, health, and therapeutics? Did not these two philosophers contemplate abstract truth in all its splendour, and after receiving it from above, was it not sufficient for them to cast their eyes upon the earth, to reflect its light, and to spread far and wide its fruitful and exhaustless seed?

Let us, then, continue faithful in the cultivation of science for itself, and trust, without anxiety, that it will bear practical fruit for itself. Our remembrance of the life of Faraday teaches us that moral truth, when implanted in a man's heart, develops, at the proper time, each virtue that life exacts. His labours show us that the same holds good with scientific truth. At the proper time, it produces, as well as many spontaneous fruits, each of those discoveries which civilisation demands.

To a nation ambitious of becoming famous in history, it should be said "Despise conquest, abandon the pursuit of riches, and seek Truth, for by that your memory will be perpetuated." In like manner it may be said to a people who desire war or fear it, who wish to remain agriculturists or seek the advantages of commerce; "Search for Truth; it will create your means of defence or attack, maintain the fertility of your plains, and furnish your manufactories with resources against competition." The princes of bygone times considered themselves enriched and assured of prolonged youth, if they could obtain an alchemist capable of making gold, and possessed of a panacea against mortality. The nations of the present day, better advised, seek the aid of chemistry, and place in its counsels their hopes of well-being and honest gain: they know the value of artificial soda, chlorine, gas illumination, stearine candles and aniline dyes, and are grateful for the labour and care which these discoveries have cost.

Everything must give way to the laws of nature, and he only who has mastered those laws can control her processes. But the mastery cannot be obtained without a struggle; the fable of Proteus is a true picture of the combat between man, eager for knowledge, and the stubborn guardian, charged with the preservation of the secrets of destiny. Proteus changed himself into a thousand shapes before speaking, and yielded only to the hero who, far from being moved by his transformations, bound him with bands of increasing pressure. Such is nature herself, her answers are always true, but like the ancient shepherd of Neptune's flocks, before allowing Truth to shine forth, she arrays herself in the garments of error, or hides herself behind the phantoms of illusion; and will only assume her proper shape under the determined pressure of a resolute disciple of Science. This indomitable courage was possessed by Faraday in the highest degree.

The struggle for mastery is often prolonged. The whole life of a man does not suffice; the meeting of many philosophers animated by the same idea, or even the labours of different generations devoted to one pursuit, are required for the attainment of success; hence free associations for the cultivation of physical science and laboratories, where young men full of faith and ardour, working under one head, unite in the execution of such plans as he may invent or approve. Private study, which was perhaps best adapted to Faraday's temperament but which prevented him from establishing a school, has been succeeded by the labours in common of learned societies, and work carried on simultaneously by pupils in the same laboratory. Enlightened countries at last comprehend that all scientific research is a battle to be won, and that every victory increases national power. Intelligent nations no longer deny to scientific men, worthy the name of captain, either arms for the contest, soldiers devoted to their cause, or subsidies for their maintenance. Science is no longer an unrecognised power of which, nevertheless, much is expected; to day, every government which does nothing for it must expect to be vanquished by rivals, and to receive the censure of posterity for its want of forethought.

When Christopher Columbus set out for the conquest of the New World, did he not require ships, sailors, provisions, and ammunition? How then can the new world of science be conquered without assistance?

For textile manufactures there must be raw material, machinery, workpeople. The best workman in England, left to his own resources, would be unable to make an inch of cloth. It is the same with scientific discoveries; to weave the weft, there must be raw material, laboratories, apparatus, and reagents. The more eminent a scientific man may be, so much the more is he powerless to resolve unaided all the questions which arise in his mind,

and to develope all the views suggested to him by the new aspects of nature, which his penetration has reached.

How many *chefs-d'-œuvre* might have been lost to us if Raphäel, protected by an illustrious Pope, had not been the centre of a brilliant and devoted school, capable of sparing him the actual labour required to develope his ideas! What discoveries will be made when scientific masters of all countries, raised to their true position, are no longer limited in their resources, confined as to their means of execution, and obliged to do everything with their own hands!

The high position held by Faraday allows of such a comparison, and we may regret the loss of the discoveries which might have been added to those with which he has benefitted the world, if, like Raphäel, he would, or could, have founded a school. Learned societies formerly chose as a subject for their solemnities, an encomium on those monarchs or ministers whose protection they enjoyed. This meeting presents a spectacle more in conformity with the dignity of science: Faraday indeed raised himself above his fellows like a prince, but as a prince of thought; he exercised his power like a minister, but as a prime minister of the power and forces of nature.

His life is likewise an epoch of intellectual progress; and our immediate posterity will speak of such and such discoveries as having been made in the time of Faraday; sure of being as well understood as if referring to events in history, as being of the time of Elizabeth or Charlemagne.

But the life of Faraday is known to you, and you are familiar with his labours. I cannot fail of rendering that homage to his memory which he would have desired himself if, together with you, I review the progress of those sciences to which he was devoted.

Since the commencement of this century, three nations, animated with a noble spirit of rivalry—England, Germany, and France—have been contending for the first place in the study of physical science. Warranted, by turns, in claiming superiority, no one of them has dreamed, for one instant, of abdicating its claims. From this generous strife have sprung innumerable labours, the boast of our age, which will imprint a character upon it in history.

I do not wish to review, nor even to point out, the advantages that these nations have received from the liberal hand of science, but to bring before our minds the acquisitions to our knowledge of matter and force, to point out those fundamental ideas which have been brought to light, and to call to mind the part we must attribute to Faraday in this wonderful movement. I propose, then, to examine what we have learnt with regard to—1st, the nature of concrete matter; 2nd, the forces which it obeys; 3rd, the nature of truly-organised matter; 4th, the force which animates it.

The Greeks considered all matter divisible into four irresolvable elements, viz., earth, water, air, and fire, which are concrete representations of the abstract ideas solidity, liquidity, gaseous state, heat. So far they were guided by their senses; but they were of opinion that, finally, matter was made up of inaccessible atoms, and that variety, in the number or the arrangement of the latter, accounted for all the varieties in natural substances.

At the present day, with Lavoisier, we give the name of elements to all substances which we cannot break up or resolve; but hold, with Dalton, that these elements are themselves made up of atoms which unite in different proportions, and with varying arrangements, to form different compounds.

To sum up, matter can be reduced to substances which no longer admit of reduction, and these substances are the elements of modern chemists; matter has only three forms, the solid, the liquid, and the gaseous, which stand for the elementary substances of the Greeks; matter is agitated by different motions, which may be all represented by one alone—heat—as all the rest may be transformed into it.

Lavoisier demonstrates that these are substances which cannot be resolved into simpler parts, and these he calls elements; Dalton asserts that the latter are substances combined in unvarying proportions, and he gives the name of atoms to these proportions reduced to their simplest form. Are not the elements of Lavoisier subject to decomposition in their turn? Cannot the methods recognised by Dalton be brought under a more general statement? May not chemistry be in the same state as astronomy with Kepler's laws, and is it not waiting for its Newton?

We are inclined to believe in the absolute simplicity of Lavoisier's elements when we consider,—1st, that, since the commencement of civilisation, no power at man's disposal, no natural action observed by him, has been able to break them up; 2ndly, that when converted into gas, their atoms occupy the same space as before; 3rdly, that in the solid state their atoms have the same volume when we deal with analogous elements; 4thly, that in the last case their forms are identical, so that they can replace and displace one another mutually in their compounds, without any great change of properties; 5thly, that the heat required by atoms for a change of temperature, is the same, no matter how they differ in weight; lastly, that in order to separate them when united, any atom whatever requires the same amount of electricity as any other. But, with the exception of inalterability, all these properties, not excepting the last, one of Faraday's best discoveries, are found in all compounds of the same order; we have, then, only a right to say that Lavoisier's elements are substances of the same order, and if we may say that they *cannot* be resolved, it is only because they *have not* been resolved.

We are inclined to think Lavoisier's elements further reducible from considering—1st, their number, which has risen in less than a century from thirty-one to sixty-five, and which grows rapidly; 2nd, their natural classification by families, the different numbers of which approach gradually, like terms in a continous series; 3rd, their indubitable analogy with organic radicals, which are compounds.

In this way, Faraday's idea, that the atoms composing simple substances are collections of centres of force diversely arranged, may be defended. Chemical atoms would be the starting point of the analysis; mechanical atoms its last stage.

However, the question has entered upon another phase since the most recent discoveries. Natural philosophy has enabled us to determine the elements which are in incandescent matter, by means of the character of the spectrum formed by the latter.

The fact that Lavoisier's elements have resisted for the millions of years that they have been on the earth all the efforts of nature and of man to reduce them, is a characteristic of simplicity. Now we can

say that these elements have resisted every effort at destruction in space as well as in time. We find in the sun, in the fixed stars, in the nebulæ, and in comets themselves—that is, within our system and without our system—the elements which we have known on earth; we find the same metals, hydrogen, nitrogen, &c.

When we are taught by the beautiful discoveries of Messrs. Janssen, Lockyer, and Frankland, that the protuberances on the sun are only incandescent hydrogen, we ask, How shall it be possible to reduce this element if the temperature of the sun do not suffice for its reduction?

As far as man can go back in time, as far as man can reach by observation in space, the concrete elements of matter present the same character as Lavoisier's elements.

In their abstract forms, reduced to mere centres of force, these elements, if such be the name for matter in its final state, belong to an immense tract, and soar up into a region of thought, inaccessible to man both in space and in time.

The examination into the modifications which have taken place in our ideas on the subject of force authorises us in going back to an age long before the commencement of this, for from thence the changes in our ideas take their date. Then matter used to be placed under the dominion of universal attraction, of motion, of light, of heat, of electricity, of magnetism, of chemical affinity, of cohesion, of the force of solution, of capillary attraction, and, later, of endosmose, &c.

It was no longer the philosophy but the mythology of Greece that served as a model. Natural forces occupied the position with regard to modern science that the divinities of old did with respect to Olympus, and people came to attribute to the former, as they had done to the latter, distinct and inalienable personalities.

At the present day, we know that light and heat have many properties in common, that electricity can be changed into magnetism, and *vice versa*, and that mechanical action can produce heat, magnetism, electricity, light. This correlation of physical force, as Mr. Grove calls it, the data for which were given by Ampére, Melloni, and before them by Sady Carnot, and confirmed by the crucial experiments of Faraday, remove all doubt. These forces are different modes of motion, and all these modes of motion can be transformed one into the other.

The man with vulgar cravings sought for the transmutation of matter, and failed to find it; he had little care for the transmutation of forces, the deep meaning of which none but the philosopher understood, and as a reward for the disinterestedness of the latter, the truth was revealed to him.

One of my most eminent fellow-labourers, one of my countrymen who has many friends here, and whom you have heard in this theatre, M. Henry Ste. Claire Deville, has just proved the existence of a close alliance between affinity and mere physical attraction, by the discovery of dissociation, which will influence the progress of chemistry materially.

We cannot deny that there exists close relationship between affinity on the one hand, and mechanical force on the other, when we see the decomposition of a body, such as marble when submitted to the action of a steady heat, come to a stand in the same way and from the same causes as the vaporisation of a liquid *in vacuo*.

This is the first step that has been taken to bring chemical phenomena under the laws of mechanics, and to justify Newton's view that chemical attraction was a particular case of universal attraction.

Has not Mr. Graham, in turn, reduced to causes purely mechanical the manifold effects of diffusion, of endosmose, of capillarity? Has not this illustrious philosopher been led by his latest researches to manifest, not only the metallic character of hydrogen by a memorable discovery, but to seize the very moment at which the phenomenon of the mechanical condensation of a gas by a porous body changes into a truly chemical combination?

There remains, then, universal attraction which, acting on heavy bodies, guides the motion of the stars as well as that of atoms; a motion which produces heat, light, electricity, and magnetism.

The study of matter leads us to the knowledge of an ever-increasing number of elements, and of simpler and simpler forces. Matter which was always believed to be conceptible and susceptible of transmutation, has resisted the efforts of man; whereas physical forces which were considered to be beyond his reach are shown to be ephemeral, and change one into the other readily.

But what relation connects gravitation with the other forces in nature? We know not; and Faraday, who has meditated on this point all his life, and who has thrown such vivid light on all its surroundings, has not made one step towards the solution of the problem.

What is the cause of gravity itself? We now know no more than was known two hundred years ago, in Newton's time.

What is meant by organic matter? If one were influenced by the views of the old chemistry, there would be no difficulty in replying. All organic matter originated in plants or animals; it was destructible by heat; it contained, generally, carbon and hydrogen, often oxygen, sometimes azote. Thus it was a compound of which carbon formed the fundamental element, destruction by fire the chief characteristic, but which, above all, derived its organic character from the circumstances of its origin.

At that time, no one thought of confounding organic chemistry and mineral chemistry. At the present day, this fusion exists in all purely chemical substances; only the terms of this assimilation are not understood. We are dazzled by a quibble. My age, and the share I have had in this movement in science, compel me to explain clearly my opinion, and to endeavour to put an end to the misconception.

The first studies we pursue on the chemical phenomena of life teach us that plants create, and animals destroy, organic matter. The sun appears as the agent by whose means this matter is produced, and combustion by the air that animals breathe, as the process that destroys them, in order to restore their elements to the state of "brut" matter.

The chemical forces placed at the disposal of life, descending on the earth under the forces of light, disappear by radiating off into space under the form of heat. An equilibrium obtains between the vegetable and animal kingdoms for receipts and disbursements, represented by these two forms of motion—light and heat; and the amount of animal life which may be developed on the globe is measured by the amount of food that vegetable life has prepared for it. The dark rays of heat appear to carry off from the earth that which radiant and brilliant light has spread over it.

On looking more closely into it, however, it was found that matter of organic origin was divided into two groups; one so rich in species that it surpasses all that has ever been imagined of the very numerous species of plants or animals described by naturalists; the other containing but a very few distinct species.

The first group constitutes the true organic species of chemists; that is to say, those which they have analysed, of which they have recognised the constitution, which they make by means borrowed from from their own sciences, and of which they can, consequently, define the nature by analyses and syntheses.

Let us first attend to these matters. At what moment can they be characterised as organic?

Their origin does not suffice. In fact, carbon, hydrogen, oxygen, azote, can be withdrawn from plants or animals, and no one would find anything but mineral elements.

Oxide of carbon, carburetted hydrogen, cyanogen, water, and ammonia may meet in the produce of the constituents of plants or animals without anyone thinking of making organic substances from these binary compounds. But old chemists gave this name to alcohol, to vinegar, to the essence of bitter almonds, to urea, for example. Now, if there is any certain principle in science, it is this. Alcohol, vinegar, essence of bitter almonds, urea, although proceeding from plants or animals, have never lived, and will never live. They are subordinate products of life; they are not necessary instruments of life.

With regard to them, chemistry need no longer hesitate. This matter is formed in the manner of mineral matter. It shows all the conditions of its composition, its structure, and its properties. One circumstance only distinguishes it, and that, even, is not absolute. Generally, mineral matter is formed of simple elements, directly united. However, we perceive sometimes that certain composite groups may act like elements, may replace them or be replaced by them in combinations, without the latter changing their general character.

That which is the exception in mineral chemistry becomes the rule in organic chemistry. Lavoisier had the presentiment of this when he wrote—"Organic chemistry is the chemistry of compound radicals."

At this day, there is no longer any doubt. Cyanogen, cacodyle, the metallic radicals of Dr. Frankland, are well-known substances, offering all the chemical qualities of simple bodies, and nevertheless compound.

The substitutions admit of displacing and replacing one element by another, or even, at pleasure, by a compound radical in all the organic matter of chemists without changing its type. The converse is true: there is no impediment to replacing a compound radical by an element in a combination; and this change does not alter the type of it more.

Thus, the organic materials of which we speak are similar in all their conditions or qualities to mineral materials; 1st, they contain certain compounds which play the part of elements; 2nd, they assimilate with the oxides, sulphides, chlorides; with acids, bases and mineral salts in all their properties; 3rd, their radicals can replace the mineral elements, and be replaced by them; 4th, they can replace each other reciprocally.

Like "brut" bodies, these materials are susceptible of crystallisation, of volatilisation, without becoming decomposed; they form definite combinations, are incapable of life, and never have lived.

They thus resemble mineral matter in every respect, and where they differ from it is only that they have the general principles of compound radicals, whilst the mineral species have generally the principles of elements.

Analogies are even apparent in some numerical relations known to the elements of mineral chemistry, and to the radicals of organic chemistry. These relations are manifest in the two cases, for all elements susceptible of being arranged in series or natural families.

Thus, lithium, sodium, potassium, whose respective atomic weights are 7, 23, and 39, form a series of which the difference is 16. Magnesium, calcium, iron, whose respective atomic weights are 12, 20, 28, form a series whose difference is 8.

Thus all organic radicals offer the same condition. Methylium, ethylium, propylium, butylium, &c., give a series whose difference is 14, their respective atomic weights being 15, 29, 43, 57.

It seems natural to conclude from all this evidence, not that substances thus endowed and composed are organic because they are derived from organised beings, but rather that the elements of mineral chemistry may be complex.

In any case, the assimilation of the two chemistries becomes more and more near.

This picture would be incomplete if we did not add a few more features.

The radicals of mineral chemistry formerly numbered 30, and the combinations known in nature raised the number to some hundreds; at this day we count 65 elements, and some thousands of compounds or natural mineral species.

The chemist of the last century might study them one by one, and become acquainted with them all. Such is not the mission of the chemist of the present day; the species being realised, he tries to study them in groups; the potential species he tries to create. In nature, every element produces, on an average, eight or ten species. In the laboratory, every element may form thousands of the same order as the known mineral species.

The contrast is still more striking in organic nature. The animals and plants which cover the surface of the earth are counted by hundreds of thousands, and yet their tissues and their juices, submitted to chemical analysis, resolve themselves into no more than a few hundreds of distinct chemical species.

But the power of combination is such, among the special elements which form them, that it is by thousands that they have arisen; and if we calculate the number of combinations of this kind which may be realised, it seems as easy to count the grains of sand on one of the great shores of the sea as to say to what number of figures may be raised the organic species which the chemist has to produce.

Thus mineral or organic species, counted formerly by hundreds, are now counted by thousands for the first and by millions for the second.

Whence comes this fecundity for the formation of the so-called organic substances? Many circumstances contribute to it; but the first results from the almost incalculable number of the compound radicals which it can realise. Each of them being able to give birth to a prodigious number of combinations, organic chemistry counts a very great number of heads of tribes, and each tribe an infinite number of species. The latter, already multiplied in fact for simple radi-

cals, are much more so by the consequences of the fertile discovery of Mr. Williamson, which has taught us to unite two different radicals to each other, to bring them into a single system, and to produce with the latter as numerous compounds as were obtained from each of the isolated radicals. In consequence of the first and fundamental discovery of Mr. Graham, on the triple functions of phosphoric acid, which has been extended to the domain of organic chemistry,—for acids by M. Liebig,—for bases by M. Berthelot,—for alcohols by M. Wurtz, the result of this harmony of work, of which the immensity alarms the imagination, is that the atomic compounds with which we were chiefly engaged forty years ago, have not only been multiplied, but that they have been repeated by counterproofs. One might say, without forcing a metaphor, that we had visited and described all the rooms of the ground floor of the building; that Messrs. Graham and Liebig have revealed to us the existence of a first and second story, which repeated all their arrangements, and that Messrs. Berthelot and Wurtz have shown us that it was the same case in the basement and in the cellars. Thus five times more chambers or species have been produced at pleasure.

But, from all the sources of multiplication of substances with which organic chemistry is concerned, the most fertile is that of substitution; in fact, the discovery of the compound ammonias by M. Wurtz, and the labours of M. Hofmann which resulted from them, have produced a multitude of combinations, in which the atoms of hydrogen contained in ammonia are replaced by compound atoms performing the function of elements—that is to say, by organic radicals. If we apply the calculation to this special case, we even see that, with the known radicals employed to replace entirely, or in part, the hydrogen, or to replace each other mutually, we should henceforth be able to produce compounds derived from ammonia by hundreds of thousands or by millions.

How if we were to apply the same calculation, and the same prevision to all the types?

There is yet more. The chemist is not now, as formerly, obliged to derive all the substances that he produces by these means from those yielded by animals and vegetables; he creates them at will; he no longer needs, for his starting point, the action of solar light on plants. When he wishes to produce organic substances, he obtains his force by employing heat, formerly regarded as the true means of destroying them.

Not that he has succeeded in directly uniting carbon, hydrogen, oxygen, and nitrogen, so as to form organic substances; but, by the aid of heat alone, he first combines them two and two, and he thus forms carburetted hydrogen, carbonic oxide, cyanogen, water, and ammonia. Afterwards, by subjecting these first compounds to the action of suitable substances, and by the necessary artifices, he succeeds in regenerating, little by little, all the definite compounds of organic chemistry.

There is not a chemist who has not performed syntheses of this character; but the most striking is that of urea, by M. Wöhler; and the first, which have been grouped in a systematic manner are those which have been performed in Germany, by M. Kolbe; and especially those performed in France, by M. Berthelot, who has worked at them with great success, being the first to reproduce formic acid, and to combine directly carbon and hydrogen.

The function of the chemist changes, and becomes elevated. In presence of the numerous substances that his power evokes from the regions of the unknown, he owes his first attention to order, method, classification, and to nomenclature. But, once this first duty is fulfilled, he contemplates this innumerable host of forms, raised by his conceptions, or realised by his hands; and he applies to mathematics for a definition of the harmonies of numbers therein revealed; to mechanics, for a statement of the laws which their structures obey, or those which determine the stability of the material systems which they represent.

The Bible tells us that when God had formed, from dust, all the beasts of the earth, and all the fowls of the air, he made them pass before Adam, and that the name given to each by Adam is its true name.

In presence of this new creation, not of animated beings—whose appearance on earth depends on a power superior to his—but of harmonious forms which chemistry reproduces at will, always identical with each other, and always distinct from all others, man might sometimes forget that he has no longer merely to give names to the works of God, in order to remember that he has to name his own works.

If the discoveries which we have witnessed during the last half century do not justify pride, they at least excuse it. But, to bring back man to our appreciation of truth, it suffices to tell him that—if he has become more expert in the art of observing, if he employs with more certainty the art of experimenting, if the logic proper to the sciences leads him more surely to the discovery of the laws of nature—he has not as yet advanced one step towards the knowledge of causes.

Let us consider, in particular, what he knows on the subject of the materials which his life sets in motion in its development, and the contrast will be striking.

If I question the physiologist, on the subject of these millions, or milliards, of compounds, misnamed organic, of which the chemist transforms, reproduces, or creates at pleasure the species, he will reply to the three following questions:—Are these compounds living?—No! Have they lived?—No! Are they capable of living?—No!

If I ask the chemist himself if these compounds belong to mineral chemistry—to the chemistry of raw (brut) substances—he will reply, Yes!

Organised matter, not capable of being crystallised, but destructible by heat, the only matter which lives, or has ever lived—this matter, a subordinate agent of the vegetating power in plants, of the motion and sensation of animals, cannot be produced by chemistry; heat does not give birth to it; light continues to engender it under the influence of living bodies.

Let us not be disturbed by a quibble. The ancients admitted that nature alone produces organic matter, and that the art of the chemist is limited to transforming it. To-day we might, perhaps, even pretend that chemistry is powerful enough to replace, in all respects, the forces of life, and to imitate its processes; let us keep to the truth.

The ancients were mistaken when they confounded, under the name of *organic matter*, sugar and alcohol, which have never lived with the living tissue of plants or the flesh of animals. Sugar and alcohol have no more share of life than bone-earth, or salts contained in the various liquids. These remnants, or rubbish of life, placed amidst organic matter, are

true mineral species, which must be brought back to, and retained amongst, "brut" bodies. Chemistry may produce them in the same sense that she manufactures sulphuric acid or soda, without, for all that, having penetrated into the sanctuary of life.

This subject remains what it was—inaccessible, closed. Life is still the continuation of life; its origin is hidden from us as well as its end. We have never witnessed the beginning of life: we have never seen how it terminates.

The existing chemistry is, therefore, all powerful in the circle of mineral nature, even when its processes are carried on in the heart of the tissues of plants or of animals, and at their expense; and she has advanced no further than the chemistry of the ancients, in the knowledge of life and in the exact study of living matter; like them, she is ignorant of their mode of generation.

Where, then, is true organised matter, or matter susceptible of organisation? What is its chemical constitution? What is its mode of production? What is its manner of growth?

Instead of myriads of species, one would feel disposed to recognise but eight or ten at most, if one may be allowed to consider elementary types of organisation as chemical species. Be this as it may, in the origin of beings which have life we see cells appear, and in the heart of their types we find cells for organic elements, and, still beyond these, germs of cells.

In these cells, or in the spaces between them, we observe inert products, aliments, excretion, substances stored up. It is the cell, it is the germs which proceed from life, which live, which engender life, and then die. The substances which are contained in, or which surround these organs, are subordinate accidents, products rejected by organisation, or destined to its use, but distinct from life.

Every organised being is born of a germ; every plant from a seed; every animal from an egg. The physiologist has never seen the birth of a cell, excepting by the intervention or as the produce of a mother cell.

The chemist has never manufactured anything which, near or distant, was susceptible even of the appearance of life. Everything he has made in his laboratory belongs to "brut" matter; as soon as he approaches life and organisation, he is disarmed.

Thus, for a century past, the empirical elements of matter have been recognised and separated; their combinations have been multiplied to infinity; physical forces have been brought back to a common origin—motion—and one has been at pleasure changed into the other; and yet—

Is the intimate nature of matter known to us? No! Do we know the nature of the force which regulates the movement of the heavenly bodies and that of atoms? No! Do we know the nature of the principle of life? No!

Of what use, then, is science? What is the difference between the philosopher and the ignorant man?

In such questions the ignorant would fain believe they know everything; the philosopher is aware that he knows nothing. The ignorant do not hesitate to deny everything; the philosopher has the right and the courage to believe everything. He can point with his finger to the abyss which separates him from these great mysteries,—universal attraction which controls "brut" matter, life which is the source of organisation and of thought. He is conscious that knowledge of this kind is yet remote from him, that it advances far beyond him and above him.

No, life neither begins nor ends on the earth; and if we were not convinced that Faraday does not rest wholly under a cold stone, if we did not believe that his intelligence is present here among us and sympathises with us, and that his pure spirit contemplates us, we should not have assembled on this spot, you to honour his memory, I to pay him once more a sincere tribute of affection, of admiration, and respect!

ON JARGONIUM;

A NEW ELEMENTARY SUBSTANCE ASSOCIATED WITH ZIRCONIUM.*

By H. C. SORBY, F.R.S., &c.

At the *soirée* of the President of the Royal Society, on March 6th, I exhibited various spectra, differing so much from those characteristic of any known substance that I considered myself warranted in concluding that they were evidence of a new element. Since this may be studied to the greatest advantage in the jargons from Ceylon, it appeared to me that, as the name *zirconium* has been adopted for the principal constituent of zircons, so that of *jargonium* would be very suitable for this constituent of jargons.

At the above-named *soirée* I gave away a printed account of the objects I exhibited; and in this I said that jargonia "is distinguished from zirconia and all other known substances by the following very remarkable properties. The natural silicate is almost, if not quite, colourless, and yet it gives a spectrum which shows above a dozen narrow black lines, much more distinct than even those characteristic of salts of didymium. When melted with borax it gives a glassy bead, clear and colourless, both hot and cold, and no traces of absorption bands can be seen in the spectrum; but, if the bead be saturated at a high temperature, and flamed, so that it may be filled with crystals of borate of jargonia, the spectrum shows four distinct absorption bands, unlike those due to any other known substance."†

I have since applied myself almost exclusively to the study of this substance, hoping to have been able to communicate to the Royal Society a full account of the subject this session; but so much still remains to be done that it is now impossible to do anything more than give a brief outline of the more important facts. The delay has not been because there is any difficulty in proving it to be a new substance, but because its properties are so unique, and have so much interest in connection with physics, that it appeared desirable to carefully examine all other known elements, in order to ascertain whether any of them exhibit analogous phenomena. That jargonium is quite distinct from zirconium is not only proved by the spectra, but also by other facts. Both myself and Mr. David Forbes have succeeded by entirely different processes in separating from jargons, zirconia apparently quite free from jargonia, and jargonia nearly, if not quite, free from zirconia; and, even if the separation be not perfect, it is, at all events, more than sufficient to prove that they are quite distinct. They are certainly very closely related, and are deposited from borax blowpipe beads in microscopical crystals of the same general form‡, quite unlike those characteristic of other known earths; but beyond this the

* Communicated by the author, having previously been sent to the Royal Society.

† For the further history of this subject, see Prof. Church's paper:—*Intellectual Observer*, 1866, vol. ix., p. 291; CHEMICAL NEWS, March 12th and 19th, 1869, vol. xix., pp. 121 and 142; *Athenæum*, March 27th; and also my own—CHEMICAL NEWS, vol. xix., p. 122; and *Athenæum*, April 3rd.

‡ See *Monthly Microscopical Journal*, June, 1869.

difference is as great as that between any other two allied elements. Judging from an analysis kindly made at my request by Mr. David Forbes, and from a comparison of the spectra, the amount of jargonia in jargons varies up to about 10 per cent. The entire or comparative absence of jargonia from the zircons of Miask, Fredericksvärn, and various other localities, appears to explain some of the facts which led Svanberg* to conclude that zircons contain more than one earth. He was so far correct, but failed to establish the existence of any substance with special chemical or physical properties; and if, as is probable, the Norwegian zircons, which, according to his views, contain such a notable quantity of this supposed new earth, as to have led him to give it the name *noria*, were from Fredericksvärn, and if the Siberian were from Miask, his norium cannot be looked upon as equivalent to my jargonium, which is almost or quite absent from those zircons.

The most remarkable peculiarity of jargonium is that its compounds may exist in three different crystalline states, giving spectra which differ from one another as much as those due to any three elements which give the most striking and characteristic spectra. Several substances can be obtained in two different physical states, giving different spectra, but usually only one of them is crystalline. The other is the vitreous or colloid condition. Crystalline minerals coloured by oxide of chromium do indeed show spectra of two different types; but, as far as I have yet seen, they never occur in the same mineral. In the case of jargonium, however, there are no less than *three* types of spectra, which are all met with in different crystalline modifications of the *self-same* compound.

The most characteristic test for jargonia is the spectrum of the borax blowpipe beads seen with a spectrum microscope, which enables us to detect it in zircons apparently

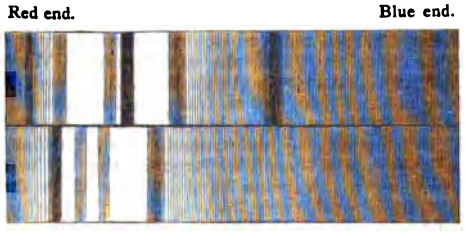


FIG. 1.

FIG. 2.

containing less than 1 per cent. As much of the earth or natural silicate as will completely dissolve should be melted in a circular loop of platinum wire about ¼ inch wide, with a mixture of borax and boric acid, and a strong heat kept up till crystals begin to be deposited, owing to the loss of the solvent by volatilisation. On removing the bead from the flame it remains clear and shows a few acicular crystals, but gives no absorption bands. On reheating to a temperature just below dull redness, the bead turns white, and so very opaque that no ordinary light will pass through it. When, however, a small and very bright image of the sun is formed in the centre by means of an almost hemispherical lens of ¼ inch diameter, and a cap is placed over the object glass, with a round hole of less diameter than the bead in the focus, so as to prevent the passage of extraneous light, the bead is seen to be illuminated by transmitted light of about the same brilliancy as that of a bright cloud, so that it gives an excellent spectrum without being at all dazzling.

In the case of beads conaining jargonia, the character of the spectrum differs completely according to the temperature at which the included crystals are deposited. As already mentioned, the clear glassy bead gives no absorption bands; and when the crystals of the borate are deposited at as low a temperature as possible, much below dull redness, and only just sufficiently high to soften the borax, there may be scarcely any trace of bands; but if the clear bead be quickly raised to a temperature just below that of very dull redness, it suddenly becomes very opaque, and shows a spectrum with a number of remarkably distinct absorption bands (Fig. 1). The most distinct and characteristic is that in the green, then one in the red and one in the blue, and there are three others fainter, one in the orange and two in the green. On raising the temperature to bright redness, all these vanish and four others appear, none of which coincide with any previously visible (Fig. 2). Three are situated in the red and orange and one in the green, so as to give rise to a spectrum of an entirely different character.* In this state the bead is of a pale straw colour, and not almost white as before. In the case of nearly pure jargonia the beads should not be above 1-25th of an inch thick, or else they would be too opaque. Pure zirconia gives no bands whatever in any state, and the beads are white, and sufficiently transparent when two or three times as thick as just named. It might be thought that these three different spectra were due to different compounds of boric acid and jargonia, if it were not that there is a similar series in the case of the natural crystalline silicate. Some of the jargons from Ceylon have a specific gravity very little inferior to that of pure zircons (4·70), and contain very little jargonia; but those of low gravity (4·20, or thereabouts) contain perhaps nearly 10 per cent, in a state which gives scarcely any trace of absorption bands. After keeping such at a bright red heat for some time, the specific gravity increases from about 4·20 to 4·60; and, judging from the imperfect data now known, this indicates that the volume of the silicate of jargonia is reduced to about one-half. The hardness becomes somewhat greater, and when examined with the spectrum microscope, the spectrum is found to be entirely changed. Instead of a mere trace of bands, a spectrum is seen which is more remarkable than that of any clear and transparent substance I have ever examined, with thirteen narrow black lines and one broader band.† No such changes occur in zircons free from jargonia like, those from Miask—no absorption bands are developed, and there is no increase in their specific gravity. In all cases this varies simply and directly as the amount of jargonia which passes from one state into the other; and if the bands are very distinct before ignition, the gravity is high and not much altered by heat.

Zircons, in their natural condition, from various localities, vary much in both the absolute and relative amount of these two modifications of jargonia; and there is good reason to believe that this difference in physical state may assist us very materially in determining the temperature at which certain rocks have been formed. Fortunately, I have met with one example of the third form of spectrum. A brown-red zircon, from Ceylon, was so dark in one part that I was not able to ascertain what sort of spectrum it would give in its unaltered condition. On heating to redness, the whole became a clear pale green; and, without examination with the spectroscope, no one would have suspected any difference between the different portions. That which was originally pale then showed the spectrum usually characteristic of heated jargons, whilst that which was originally very dark showed one entirely different, corresponding exactly with that of the borate deposited in blow-pipe beads at a medium temperature. It also corresponds in general character, but not in detail, with that of the blue spinels from Ceylon, which I believe contain a small quantity of jargonia. That part of the zircon which gives this spectrum appears to have had the same remarkably low specific gravity of about 4·0, both before and after ignition, as though the volume of the silicate of jargonia in this state were even greater than in that which gives no bands.

* *Pogg. Ann.*, 1845., vol. lxv., p. 317.

* June 30th.—I have since been able to examine these spectra with unusually good light, and have found another band in the blue in spectrum Fig. 1, and another in the extreme red in spectrum Fig. 2.

† CHEMICAL NEWS, vol. xix., p. 122.

These various spectra of jargonium are all of a very marked character, quite unlike those due to any other element in similar conditions.

The change produced by heating the jargons is, to some extent, analogous to what occurs on heating arragonite, but yet differs in many most important particulars. When arragonite is thus changed into calcite, it becomes an opaque mass of small crystals, the specific gravity and hardness are diminished, and there is no difference in the spectra of these two different modifications of carbonate of lime; whereas, after heating, the jargons are still as simple and transparent crystals as at first, the specific gravity and hardness are increased, and the spectrum totally changed. Iodide of mercury is an excellent illustration of a difference in the spectrum due to a change in the crystalline state, produced by heat; but there are only two modifications—the scarlet and the yellow. The existence of three crystalline conditions is, in some respects, analogous to what occurs in titanic acid. Anatase, brookite, and rutile are three distinct crystalline modifications of the same substance; but they do not differ very much in specific gravity, and their spectra do not present any characteristic differences. On the whole, the different states of carbon—charcoal, graphite, and diamond—are, perhaps, the best illustration of the existence of three distinct modifications, which differs much in specific gravity and optical characters; since one is black, the second has a metallic lustre, and the third is colourless and transparent; but these are variations in the element itself, and not, as in the case of jargonium, modifications of its compounds. So far as I am aware, there is indeed, no substance which shows strictly comparable facts.

There cannot, then, I think, be any doubt whatever that jargonium is not only a new elementary substance, but is, also, one likely to throw much light on several important physical questions. By the time that the Royal Society resumes its meetings, I trust that I shall be able to send a complete account of the whole of my investigations, including such facts connected with other substances as may serve to illustrate the very peculiar properties of this hitherto unrecognised element.

POSTSCRIPT (June 16th).

Since Professor Church has published some papers on the existence of a second earth in some zircons, it may perhaps be well to give a short account of what he has done. He was the first to observe the absorption bands, and gave an account of them in the *Intellectual Observer* for May, 1866 (vol. ix., p. 201). In that paper he said nothing about a *new* elementary substance, and does not even seem to have been convinced that they were not due to zirconia, since he speaks of silica as "the other constituent of zircons," as though there were but two constituents—silica and zirconia. However, since he had found that some zircons show the bands much better than others, he said that he was "induced to hazard the conjecture that it may be, after all, the presence of Svanberg's *norium* which determines the difference." I have now shown that jargonia may exist in very considerable quantity in zircons in such a physical condition as not to show any bands, and it was quite as probable that their presence or absence might have been due to a similar variation in the physical state of zirconia itself; and therefore no fact described in Professor Church's paper can now be looked upon as proof of the existence of a second earth. His paper does not appear to have attracted much attention and I was quite ignorant of it until after I had printed, for distribution at the *soirée* of the Royal Society on March 6th, an account of the characteristic peculiarities of jargonia. Up to that time he had never so much as even suggested the existence of a *new* earth, and the first time that he did so was in his paper subsequently published in the CHEMICAL NEWS of March 12th, manifestly written because he had "heard, when in London, that Mr. Sorby had discovered a new set of black absorption bands in certain zircons, and had attributed their occurence to the presence in the stones examined of a new element accompanying zirconium." In this paper he suggested that the name *nigrium* might be appropriately adopted, but did little more than recapitulate the arguments previously brought forward by Svanberg in proof of the existence of *norium*, viz., a difference in the specific gravity of the zircons, in the atomic weight of the earths, and in some obscure and doubtful chemical properties; but he never proved that the bands might not have been due to several well-known elements, and that the above-named differences depended on the substance which gives the peculiar spectrum. I therefore maintain that I was the first, not only to suggest, but also to prove, the existence of a new element by my blowpipe methods, and to show that the earth may be separated from zirconia and obtained in a state of approximate purity.

POSTSCRIPT (June 18th).

I here subjoin a brief account of the methods employed by Mr. David Forbes* and myself in separating zirconia and jargonia from one another. He separated apparently pure zirconia by means of strong hydrochloric acid, which dissolved the chloride of jargonium, but left chloride of zirconium undissolved, and obtained the approximately pure jargonia by adding to the solution excess of ammonia, and then considerable excess of tartaric acid, which left most of the tartrate of jargonia insoluble, but dissolved what may turn out to be a mixture of zirconia and jargonia with a third substance not yet sufficiently studied—perhaps Svanberg's noria. My own analysis was only qualitative. I fused powdered jargon with several times its weight of borax, which gave a perfectly clear glass, completely soluble in dilute hydrochloric acid. After separating the silica in the usual manner, a slight excess of ammonia was added to the hydrochloric acid solution of the earths, and then some oxalic and hydrochoric acids, which left undissolved apparently pure zirconia that had passed into an imperfectly soluble state. To this solution so much ammonia was added as to give a very copious precipitate, but yet to leave the solution with a very decided acid reaction. After removing the precipitate, which was chiefly oxalate of zirconia, almost or quite free from jargonia, excess of ammonia was added to the solution, and the washed precipitate digested in dilute hydrochloric acid to remove per oxide of iron. The insoluble portion must have been approximately pure oxalate of jargonia, for it gave the characteristic spectra described above in remarkable perfection. Though this method succeeded far better than I anticipated, I do not yet understand the exact conditions requisite to ensure success, and have been prevented by absence from home from making further experiments.

Jargonium.—We learn from the *American Journal of Mining*, of June 12th, 1869, that, at a meeting of the Polytechnic Association of the American Institute, held on June 3rd, a note was read "*On Jargonium*," which referred to the exhibition of jargonia by Mr. Sorby at the *soirée* of the Royal Society, and also to the communication by Professor Church in the CHEMICAL NEWS for March 12th. After the reading of the note, Dr. Isidor Walz spoke as follows:—"It will be remembered that, at a meeting of the New York Lyceum of Natural History, Professor Loew announced the discovery of jargonium before the number of the CHEMICAL NEWS which contained an account of Mr. Sorby's discovery had reached this country. The discovery was, undoubtedly, made by the English and American discoverers quite independently of each other."

* CHEMICAL NEWS, vol. xix., p. 277.

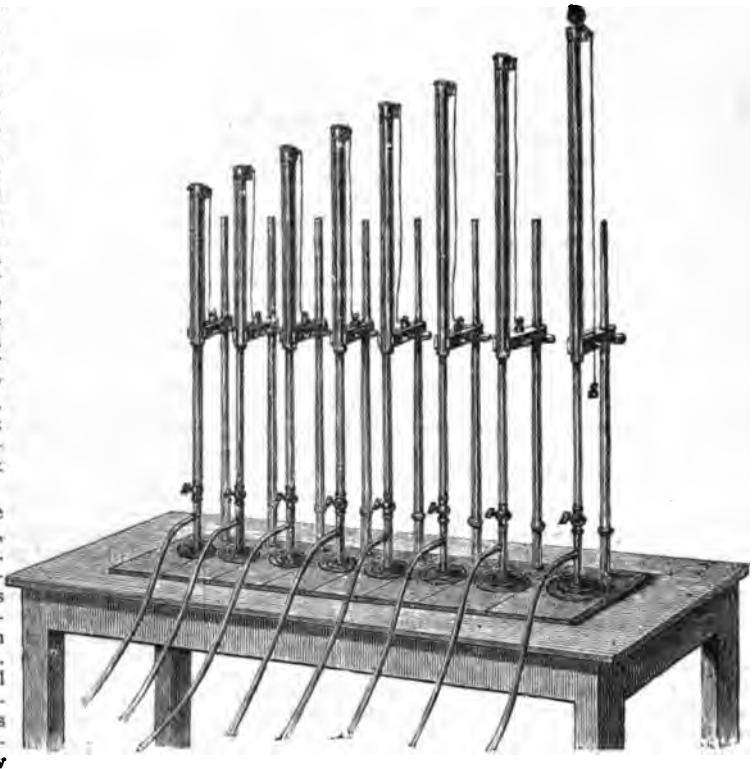
NOTICES OF BOOKS.

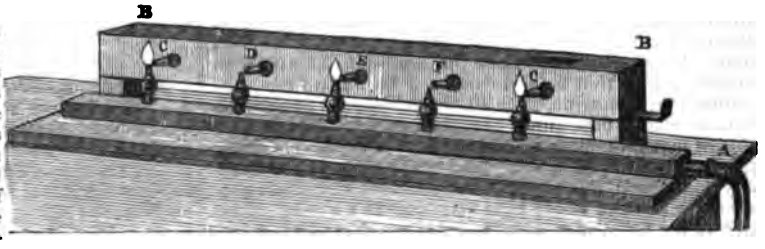
Cyclopædic Science Simplified. By J. H. Pepper. London: Frederick Warne and Co. New York: Scribner, Welford, and Co. 1869.

Of a verity this book is a small cyclopædia of science; the variety of subject matter is astonishing, and six hundred woodcuts lend their aid to the simplification. Within the memory of most of us the only source of very popular science for boys was to be found in the "Boy's Own Book," where the science was bounded on the right by perhaps Cricket, and on the left by Boating, and the dominant experiment was the "Lead tree," while examples of chemical combination were ordered to be made somewhat after this fashion:—"Take a sixpence, put it in a small tea-cup, and pour upon it about a wine-glass full of aqua fortis; it will immediately dissolve; now add a pinch of salt, and the silver will fall down as a white powder," and so on. Now, for having led boys from such science as this, and given them sound science resulting from the labours of sound men, and often accompanied by their own explanations, we think every school-boy ought to thank Mr. Pepper. He cannot open this book without having his mind simultaneously opened, and it is his own fault if he ever closes it again.

As for subject matter, we have light, heat, electricity, magnetism, pneumatics, acoustics, and chemistry. In the article on Light, a detailed account, accompanied by woodcuts, is given of the celebrated ghost delusion, which surprised us all so much a few years ago, and of which M. Marion has given such a capital account in his *Merveilles de l'Optique*, one of that admirable series well called "Bibliothèque des Merveilles," from whatever point of view we may consider it.

If we specialise at all we may perhaps mention the chapter on Acoustics as being well illustrated. The accompanying figure represents the "gas flame organ," by means of which, we are told, simple tunes have been played; while in the second figure, we have the apparatus of Pichler for showing the position of the nodal points and ventral segments in a vibrating column of air. When the column of air in the tube, B B, is caused to vibrate, the gas jets, D and F, which are opposite to the centres of ventral segments, are blown out, while the jets, C, E, G, remain lighted, because they are opposite to nodal points—that is, points where the column of air is at rest.





Mr. Pepper also tells us lots of scientific "dodges," explains the talking head of Albertus Magnus, and indicates the true position of the "invisible girl," who, being in communication with "a sort of ornamental bedstead," yet all unseen, answers any questions addressed in the neighbourhood thereof. But there is much severer science than this; we would refer to the accounts of magnetism and dia-magnetism specially, also to the account of the Atlantic cable; in fact, we recommend all young fellows with any glimmer of a taste for science, to take the book home with them at the approaching summer holidays, to read it carefully, and, as far as is possible, experimentalise for themselves.

Endowment of a School of Practical Chemistry.—Mr. James Young, the late proprietor of the extensive works at Bathgate, near Glasgow, and manufacturer of paraffin and paraffin oils, whose name, in fact, is intimately associated with this manufacture as the discoverer of the process by which these valuable products have for many years been produced from certain varieties of coal, is stated to have presented the sum of £10,000 to the Andersonian Institution, Glasgow, for the endowment of a school of practical chemistry.—*Pharm. Journ.*

LABORATORY NOTES.

ACTION OF SODIUM ON WATER AND NITRIC ACID.

I send a few facts which you may perhaps consider worth a place in some corner of the CHEMICAL NEWS.

When sodium is thrown upon water, the hydrogen does not kindle, as we all well know, unless the water be warmed, or the metal confined to one spot by blotting-paper. If sodium, however, be dropped upon nitric acid of specific gravity 1·36 (ordinary commercial), the hydrogen burns with ease; but if the acid be diluted this result ceases. I thought it of interest to ascertain the point of dilution, which was conducted in the following way:—The concentrated acid, to the extent of 680 grains, was placed in a beaker, which again was placed in a vessel of water; a fragment of sodium of equal size was then added, the acid being diluted with 25 grains of water before each addition of sodium. The rise of temperature consequent upon this dilution (always two degrees) was allowed to fall back to that of 66° F., at which the experiments were commenced. Seventy-two experiments gave as the result, that the hydrogen ceased to kindle when the acid was diluted to specific gravity 1·056. The residue contained a fair amount of ammonia. I have used this dilute nitric acid with advantage, when showing the preparation of hydrogen by potassium and sodium as a lecture experiment, as the results then appear similar. No doubt the rapid oxidation of the sodium into nitrate is the explanation.—I am, &c.,

THOMAS BLOXAM,
Lecturer on Chemical and Natural Philosophy, Cheltenham College.

CORRESPONDENCE.

THE FARADAY MEMORIAL.

To the Editor of the Chemical News.

SIR,—I read with regret that the proposed memorial to Faraday is to be in the form of a statue in St. Paul's Cathedral. I am very sorry to differ from those who, doubtless knowing Faraday better than I did, though they could not have loved him more, support this proposal. Government has refused to contribute anything to the memory of this great man on the ground that he did not hold the position of a public servant. Had he been a fighting man, doubtless a statue would have been raised to his honour. But why should we attempt to rival Government in erecting a statue in a state church? Ought we not rather to make our memorial take a scientific and beneficent form, such as Faraday himself would have approved? England can do many things well, but she cannot make an artistic statue. Why then should we waste this splendid opportunity of doing good in the production of a wooden figure at great cost? And the good I would propose, is the creation of a permanent fund for the encouragement of poor students in science, and poor investigators. Many would give—I for one—their five guineas to such a fund, who would withhold it if the money is to be spent on stone. There are poor boys in poor schools who display an unusual amount of talent, but for want of means or patronage have no opportunity of rising. Could not such boys be collected in a Faraday College, and trained up in science? We might thus get the pick of undeveloped talent throughout these islands.

Faraday, who shunned empty titles, does not want a statue. His kindly feeling was always extended to workers in science. I have several times received a word of encouragement from him, either written or spoken, when it was most refreshing because most needed. I will mention an example of his self-denying kindness which is not, I believe, known, although thousands of such cases might be collected, for no one came in contact with Faraday without receiving some benefit.

Mr. Weale, the publisher, told me that a scientific man having agreed to write a book for him, delivered the copy and then had to go abroad. Mr. Weale read the proof-sheets. In one sheet several difficulties occurred which he could not solve. Not knowing who to apply to, he bethought himself of Faraday, although personally unknown to him. The messenger arrived at the Royal Institution, delivered the parcel, and said he would wait. "It is of no use," said the porter, "Mr. Faraday is unwell and is ordered out of town; he is just going to start." While the messenger was remonstrating, Faraday appeared, carpet-bag in hand, took the packet, and read the letter. "O, yes," said he, "I will do this for Mr. Weale. I can go by the next train."

Can the memory of such a man be honoured by resorting to the worn-out custom of erecting an ugly statue?—I am, &c.,

F.R.S.

June 25th, 1869.

SUPERPHOSPHATES.

To the Editor of the Chemical News.

SIR,—I observe in the CHEMICAL NEWS of last week an enquiry regarding the possibility of distinguishing between mineral and bone phosphates in superphosphates. If your correspondent will take two samples, one of a bone-ash and the other a coprolite superphosphate, and precipitate the insoluble phosphate by ammonia, and burn the precipitates, he will see that there is such a marked difference in the appearance of the two as to render it very easy to distinguish the one from the other.

Should your correspondent desire it, I shall be most happy to give him any information I can on the subject.—I am, &c.,

ARTHUR E. DAVIES, Ph.D.

Analytical Laboratory,
St. Mary's Gate, Manchester,
June 30th, 1869.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

Comptes Rendus des Séances de l'Académie des Sciences (No. 25), June 21, 1869.

Omitting the purely astronomical, mathematical, and other memoirs and papers of no direct interest to readers of our paper, we notice a memoir—

On a Homologue and Isomer of Choline.—M. Wurtz.—The author says—Some time ago I pointed out that, when chlorhydrate of glycol fixes and combines with trimethylamine, the result is the formation of a new basis identical with neurine as obtainable from brain. Since the identity of choline, which M. Strecker has extracted from liver, and the base just alluded to, has been proved, I shall call neurine henceforward choline. The reaction above mentioned is represented by the following formulæ:—

$$\underbrace{(C_2H_5)_3N}_{\text{Triethyl-amine.}} + \underbrace{C_2H_4\left\{\begin{matrix}OH\\Cl\end{matrix}\right.}_{\text{Chlorhydrate of glycol.}} = \underbrace{\left.\begin{matrix}C_2H_4.OH\\(C_2H_5)_3\end{matrix}\right\}NCl.}_{\text{Chlorhydrate of hydroxethylentri-ethylammonium.}}$$

This salt is soluble in water and alcohol, crystallises in prisms, and yields, with chloride of platinum, a crystalline double-salt made up according to the following formula:—

$$\left[\frac{C_2H_4.OH}{(C_2H_5)_3}N.Cl\right]_2 + PtCl_4.$$

The hydrate of hydroxethylen of triethylammonium, $C_8H_{21}NO_2$, is evidently a homologue of chinoline, $C_3H_{15}NO_2$. The author's paper describes, at very great length, the preparation of many complex compounds like those named, and, lastly, promises a detailed account of this portion of his labours.

Some Isopropylic Compounds.—M. Da Silva.—Butyrate of isopropyl is a colourless liquid; odour disagreeable; boils at 128° C.; is inflammable, and burns with a bright flame. Its vapour density is 4·73.—Valerate of isopropyl is also a liquid, colourless, inflammable, of a disagreeable odour, and of less density than water. Its specific gravity, at 0° C., is 0·8702; vapour density, 5·004; and boils at 142° C.

Coal-Tar Oils which Boil at about 200° C.—M. Romier.—The author says—Having obtained, through the kindness of the chief engineer and chemist of the United Parisian Gas Works Company, M. Audouin, 16 litres of heavy coal-tar oil, I have therefrom obtained about 4 litres of oil, perfectly freed from naphthaline, phenol, and alkaloids, and boiling at between 170° and 225° C. Leaving out of the subject of his research all fluids contained in the aforesaid 4 litres boiling below 176° C., and which in bulk represented 3½ litres, the author has obtained three oils of constant boiling point, respectively boiling at between 176° and 179°, at between 196° and 198°, and, lastly, at between 200° and 225° C. These oils are colourless, lighter than water, and exhibit an odour reminding one of that of oil of turpentine; they have been submitted to a series of experiments; and the author states that they are cymens and hydrides of formen.

Analysis of the Meteorite of Kernouve, near Cléguérec, Morbihan, Fallen on the 22nd of May last.—M. Pisani.—The entire weight of this mass, before it was broken up, was about 80 kilos.: the piece from which a portion has been applied for analysis weighed 16 kilos. The specific gravity of this meteorite is, on an average, 3·747. The result of the analysis, in 100 parts, was as follows:—Iron, 22·25; nickel, 1·55; sulphur, 2·15; copper, a trace; chromate of iron, a trace; silica, 32·95; alumina, 3·19; protoxide of iron, 11·70; magnesia, 23·68; lime, 1·89; soda, with traces of potassa, 1·41.

Polytechnisches Centralblatt, No. 9, May 1, 1869.

We do not propose regularly to quote this periodical, which is chiefly devoted to mechanics and engineering; but whenever it happens to contain, either original papers of interest to our readers, or, as now and then occurs, abstracts of interest from German, Swedish, or Russian periodicals, which from their limited circulation have not become generally known, we shall make the necessary abstracts.

Ready Method of Preparing Phosphuretted Hydrogen Gas.—Dr. H. Schwartz says, When the pulverulent metallic zinc which is deposited in the tubes of the Belgian (Vieille Montagne) zinc smelting furnaces, is mixed with amorphous phosphorus in powder, in the proportion of one part of zinc to two of phosphorus, and this mixture, after having been introduced into a hard-glass combustion tube, is gently heated therein, while, at the same time, a current of dry coal gas or dry hydrogen gas is passed through the mixture, phosphide of zinc is formed; it is necessary to cool the tube and mixture while the current of gas remains turned on. From the phosphide of zinc so obtained phosphuretted hydrogen may be readily prepared by means of dilute sulphuric acid, or by boiling with caustic potassa solution; the gas evolved is, however, the non-spontaneously combustible kind; the spontaneously combustible gas may be obtained by applying a larger quantity of the phosphide of zinc and warm dilute sulphuric acid.

Analysis of some Colouring Substances used for Staining Glass and Faience Ware.—Dr. H. Schwartz.—A bright brown colour was found to consist in 100 parts of—Oxide of chromium, 11·30; peroxide of iron, 21·00; alumina, 18·02; oxide of zinc, 50·90; this material may be prepared as follows: 71 grms. of chrome alum; 60 grms. of persulphate of iron; 160 grms. of alum, and 180 grms. of sulphate of zinc, are dissolved in water, and after having been mixed, precipitated by means of carbonate of soda, collected on a filter, washed, dried, gently ignited, and rubbed to powder in an agate mortar; a reddish brown colour consisted in 100 parts of—Oxide of barium, 19·82; oxide of chromium, 11·07; peroxide of iron, 7·70; alumina, 2·30; Silica, 10·40; Sulphuric acid, 5·47; carbonic acid and alkali, 3·81.

Bulletin de l'Académie Impériale des Sciences de St. Petersbourg, Vol. xiii.

This periodical contains only one paper relating to chemistry—A memoir, or rather, and more correctly, a fresh instalment of a memoir:—

On Hydrocarbons.—M. F. Fritzsche.—(Read at the meeting of the 4th of February last). The author says, I call Photen the substance $C_{14}H_{10}$, fusing at 210° C.; in pure state it is always a somewhat yellowish coloured solid, soluble in very strong alcohol, exhibiting in solid as well as in a fused state a violet fluorescence. Phosen, another hydrocarbon, fuses at 193° C.; by the action of sunlight this substance is entirely altered in its properties, and the so altered matter is called paraphosphen by the author; by simple fusion this latter is again converted into phosen. The author describes at great length the preparation in pure state of the two substances alluded to, discusses their crystallographical properties; describes oxyphoten $C_{14}H_8O_2$; oxybinitrophoten, dioxyretnsten $C_{14}H_{11}O_4$; but these descriptions and the record of the properties, and mode of preparation of these substances, are so lengthy, and, moreover, so interspersed with discussions on other, although not in this respect quite irrevelant, matter, that it is impossible to give a condensed abstract which will do justice to the author.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1641. J. Wilson, Royal Exchange Buildings, London, "Improvements in the manufacture of wrought iron."—A communication from I. O. York, New York, U.S.A.—Petition recorded May 28, 1869.

1713. I. Hopkinson, Leeds, "Improvements in the manufacture of artificial fuel."

1717. F. Rave, Manchester, "An improved method of extracting colour from vegetable matter."

1719. W. V. Morgan, Cannon Street, London. "Improvements in the manufacture of crucibles and other refractory articles or vessels."—A communication from J. L. Hall, and J. V. Morgan, Montreal, Canada.

1721. J. H. Johnson, Lincoln's-Inn-Fields, Middlesex, "Improvements in the manufacture of iron."—A communication from J. Burt, Detroit, Michigan, U.S.A.—June 3, 1869.

1731. J. Duke, Mannamead, near Plymouth, "Improvements in the manufacture of plaster and cement."—June 4, 1869.

1742. T. W. Arkle, Liverpool, "Improvements in the mode and means for extracting, recovering, or collecting copper from water containing the same in solution, and in apparatus therefor."—June, 5, 1869.

1782. A. St. C. Radisson, Lyons, France "Improvements in the treatment of oleine and other fatty matters for the purpose of transforming them into solid materials suitable for the manufacture of candles."

1785. W. L. Wise, Adelphi, Westminster, "Improvements in the manufacture of artificial fuel and in apparatus for the purpose."—A communication from B. Le Quesne and Dumontier, St. Servan, France.—June 9, 1869.

1800. G. W. Oliver, Liverpool, "Improvements in the manufacture of explosive powder and in machinery to be used in such manufacture."—A communication from P. A. Oliver, New York, U.S.A.—June 10, 1869.

NOTICES TO PROCEED.

319. W. A. Smith, Manchester, "Improvements in the preservation of meat, fish, and other perishable articles of food during their carriage by railway, and in apparatus connected therewith."—Petition recorded February 2, 1869.

374. H. A. Bonneville, Chaussée d'Antin, Paris, "A new and improved compound for preparing jelly broth."—A communication from C. J. Deanoix, Paris.—February 6, 1869.

420. J. Clayton, Radcliffe, Lancashire, "An improved paste for fixing and brightening aniline and pigment colours in printing on cotton, woollen, silk, or mixed fabrics."—February 10, 1869.

442. W. E. Newton, Chancery Lane, "Improvements in the manufacture of explosive compounds."—A communication from A. Nobel, Paris.—February 12, 1869.

657. J. Townsend and P. Forbes, Glasgow, N.B., "Improvements in refining or purifying oils and fats."—March 2, 1869.

942. E. Morewood, Rock Cottage, Briton Ferry, Glamorganshire, "Improvements in coating metals."—March 29, 1869.

1317. A. Meredith, Newgate Street, London, "Improvements in the manufacture of iron and steel."—April 28, 1869.

1469. J. Townsend and P. Forbes, Glasgow, N.B., "Improvements in refining or treating oils and fats, and in apparatus therefor.—May 13, 1869.

1539. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved process for obtaining gelatine and other products from animal substances."—A communication from D. K. Tuttle, O. Lingo, W. J. Hooper, and T. Hooper, Baltimore, Ma., U.S.A.—May 19, 1869.

1575. C. W. Siemens, Great George Street, Westminster, "Improvements in calcining and smelting ores, and in furnaces and apparatus employed in connection therewith, which furnaces are also applicable to other purposes."—May 21, 1869.

1642. J. Brömer and H. Gurzkow, Frankfort-on-the-Maine, "An improved method of obtaining the anthracen out of asphaltos, that is to say, pitch produced from coal tar, and of preparing two colouring matters from the anthracen."—May 28, 1869.

TO CORRESPONDENTS.

*** *In consequence of the enlargement of our Journal by the introduction of abstracts of all the foreign periodicals, the index is much larger than it has hitherto been; we have therefore issued with this a supplement, which contains the title-page, preface, and a copious index to the volume just completed. The price is the same as for an ordinary number.*

THE CHEMICAL NEWS.

VOL. XX. No. 502.

ON

HEAT TREATED AS A SCIENCE OF KINETICS.*

By G. F. RODWELL, F.C.S.

I.

WE are surrounded by actions which we cannot readily recognise. There are actions of the nature of those which constitute light—differing not in kind, and but slightly in degree—which are unseen; there are other actions, similar to those which constitute sound, which are unheard; and others, again, similar to those which constitute heat, which are unfelt. Vast ranges of phenomena are beyond the direct cognisance of the senses. The organs by which external impressions are received and conveyed to the brain, although admirably perfect,—I need not say far *more* perfect than our most delicate and refined instruments—are yet, be it remembered, exercised solely in regard to the welfare of the organism of which they form a part. They are devoted to that organism, and exist for the purpose of enabling it to resist adverse assaults, whether of external agencies, or otherwise; to comply with all the demands requisite for the conditions of life, and to transform the external actions of the material world into actions capable of being recognised under some definite form by the centre of perception—the brain. The actions, or motions, which are thus received and transmitted by the nerves, are such alone as are requisite for the well-being of the entire organism. Light, sound, and heat are varieties of motion; but the nerves of seeing, hearing, and feeling only transmit certain of those motions: if they pass a well-defined limit of quickness or slowness, they cease to be transmitted. But these same relatively quick and relatively slow motions, although incapable of being directly recognised by us, do not the less profoundly influence matter. It is the object of natural philosophy to investigate *all* the actions by which matter is influenced.

Thus our senses are limited in their capability of observation. Their operations are finite. Hence, when we pass from the influence of the so-called *physical forces*—light, heat, electricity, chemical action—upon ourselves to their influence upon matter external to ourselves, it is necessary for us to assist and exact the capabilities of the senses in the particular direction required, and to free the intellect from impressions produced by unaided observation, the bias so resulting, and from the *idola specus* of which Bacon speaks, for we have all of us in our minds "*specum sive cavernam quæ lumen naturæ frangit et corrumpit.*" It therefore behoves us when we study natural philosophy—specially any branch of it submitted to a mode of treatment more assimilable with reason, but less so, perchance, with unaided observation than some older and long-dominant system—it behoves us, I say, to receive with caution, and to carefully examine and analyse the impressions conveyed to us by our unassisted senses, and to put from our minds all preconceived notions, whether derived from directly-received impression, or indirectly from the authority of some older physical system; and this I will ask you to do at the outset. And when, as will frequently be the case, I shall have to speak to you of minute, invisible particles or molecules of matter, endued with functions, attributes, and influences, diverse in form, and varied in character, and such alone as we are wont to associate with larger masses of matter, capable of being seen, and handled, and weighed, I will ask you to grant me some faith, and some imagination. If you find difficulty in doing this in this particular direction, remember that every grain of sand upon the sea-shore is a microcosm, sharing in the innate motions which pulsate through the Universe; and remember, further, that there are specks, infinitely smaller than grains of sand, in which a heart beats, and blood circulates, and all the functions of an exuberant vitality are exercised; and thus, by comparing the unknown with the known, faith may be lessened, and imagination not too tensely stretched.

I had intended to have adopted a different name for the subject of this course from that which appears on the syllabus; to have replaced the word *heat* by some term which, as I thought, would better associate in your minds the idea of motion with that of heat; such as *thermo-kinetics* (from θερμος heat; and κινησις, motion), or *thermo-dynamics*; or to have spoken of it as *a certain motion appertaining to matter*. I had intended to have done this, when, on enquiring into the etymology of our word *heat*, I found that the term is peculiarly appropriate, although the science which it designates has, of late, undergone the most profound changes. The word *heat* is closely related to the Anglo-Saxon *haets*, the Gothic *haitan*, the Icelandic *hita*, and the old High German *eit*; and these words agree, by Grimm's law, with the Greek αιθος, fire, from αιθω, to kindle; mark, also, the related words αιθοψ, αιθυσσω, and (perhaps) αιθηρ. The celebrated physiologist Bopp, carries back the derivation to a Sanskrit root—*indhe*, to shine; and traces it through the Greek αιθος, the Latin *æstus*, and the old High German *eit*, to our word *heat*. "*Æstus*," says Vossius, in his "Lexicon Etymologicon," *est commotio, vel in igne, vel in aqua, vel in animo. Omnis autem commotio fervorem gignit.*" Now, as it will be my object to show that heat *is* a commotion of the small particles or *molecules** of matter, I think you will agree with me that the term could not be changed with advantage.

From an early age, the idea of motion has, in some form or other, been associated with that of heat. I may remind you that, in αιθυσσω, to put in rapid motion, to kindle (from αιθω), we have distinct reference to this; and, moreover, that αιθηρ, from which we have our word *ether*, was sometimes used to express fire. From the supposed proximity of the sphere of ether to the sphere of fire, and the generation of the latter from the former, the ether was sometimes regarded by the ancients as a very pure fire; invisible all-pervading, and in perpetual motion; indeed, as a something approaching to the nature of what we now call heat. Now if, as Aristotle affirms, αιθηρ is derived from αει, always, and θεω, to move swiftly, we have here additional evidence that, at an early period, the idea of motion was associated with that of heat.

"*Æstus est commotio . . . omnis commotio fervorem gignit.*" I will define heat as a rapid motion of molecules of matter. This motion, when transmitted to the brain by the molecules of the sensory nerves, produces in us the sensation by which heat is familiarly known.

Let us now briefly trace the rise of the two theories which for so long a time prevailed in regard to the nature of heat. Epicurus regarded heat as an effluxion of minute spherical particles which, in virtue of their smallness, and of the rapidity of their motion, insinuate themselves into the densest substances, and thus expand, and eventually disintegrate them. Lucretius, who followed Epicurus somewhat closely, maintained that both light and heat are caused by the vehement motion of small primary particles—*primi minuti*, as he calls them. The majority of the ancient philosophers regarded fire (under which term was included both light and heat) as an element more divine than air, water, and earth; it was to them the acting agent of the Universe, the *force* exercising itself upon *matter*. The function of fire is well signified in the story of Prometheus, who, you will remember, is related to have stolen fire from heaven, and therewith

* A course of four lectures delivered at the London Institution.

* *Molecula*, a little mass; a Low Latin diminutive of *moles*, a mass; a mass of incommensurable minuteness.

vivified mankind. Fire was the *anima*, while tangible matter was the *corpus*.

The ideas of the ancients regarding the nature of heat were very generally adopted during the middle ages. Cardanus frequently speaks of *motus ignis* and *motus caloris*. Telesius, of Cosenza, a philosopher far in advance of his time, asserted that heat is the cause of motion, cold of rest, and that these principles together produce all the phenomena of the universe. Robert Fludd (also known as Robertus de Fluctibus), the founder of the Fluddists, affirmed that heat is the ultimate effect of the action of light, and that it results from the motion of material particles. Francis Bacon was one of the first to deny the elemental nature of fire, by asserting that it is "merely compounded of the conjunction of light and heat in any substance;" elsewhere he defines heat as "not an expansive motion of the whole, but of the small parts of a body." As an example of the production of heat by the transformation of visible motion, he mentions that a piece of metal when hammered becomes hot, and that if the hammering were continued, it would possibly become red-hot.*

About twenty years after the death of Bacon, the *Principia* of Descartes appeared. In it we find the development of one of the most comprehensive kinetic systems which has ever appeared in the history of science. (By *kinetic system* I mean a system in which the phenomena of the universe are accounted for on the supposition that they are caused by various motions). It is impossible at the present time to enter into any detail account of the Cartesian philosophy. I may mention, however, that Descartes supposed the existence of three elements, by the mutual interaction of which all natural phenomena are produced. The first element, the *materia cœlestis*, corresponding somewhat to the *αἰθηρ* of the Ancients, is a very subtle medium, possessing perpetual and vehement circular motion, and it is the cause of all the motion in the universe; the second element is more gross, and it embraces all gaseous matter, while the third element embraces all solids and liquids. Thus the first element, which actuates by its motion the second and third elements, corresponds somewhat with what we now call a *force*. Heat, according to Descartes, is a rapid circular motion of the particles of the third element, communicated by the materia cœlestis. The particles of oils and fats, and of combustible bodies generally, are peculiarly adapted to the reception of this motion, and such bodies he designated "potentially hot." Among other passages which bear upon the kinetic theory of heat, I find the following in the fourth book of the *Principia*:—"A nail which is being driven into a block of wood does not become hot until after it has been driven home by the hammer, because heat is not a motion of masses, but of small particles, and so long as the nail itself is capable of moving, the force of the blow is expended in producing the motion of a mass, not in moving the small particles of the metal." The nature of heat, according to the Kinetic theory, received a very apt expression in the following definition given by John Locke:—"Heat is a very brisk agitation of the insensible parts of the object, which produces in us that sensation from which we denominate the object hot; so that what in our sensation is *heat* in the object is nothing but motion."

Towards the close of the seventeenth century, there arose a theory which endeavoured to trace the cause of a number of phenomena to the absorption or rejection of "*materia aut principium ignis, non ipse ignis*," better known as the theory of Phlogiston (from *φλογιστος*, burnt). This theory profoundly influenced the scientific world for more than a century, and it led to an extended theory of materialised heat.

We thus perceive that there had gradually arisen two distinct theories in regard to the nature of heat, for while some regarded it as a motion of the molecules of matter,—as a condition, or attribute of matter, others regarded it as matter itself, subtle indeed, and infinitely thin, but yet a kind of matter capable of being absorbed or rejected by other and grosser matter. The former of these is the *Kinetic theory of heat*, (*κινησις*, motion), and is now generally, if not universally, adopted; the latter is the *material theory of heat* (*materia*, matter), and it was almost universally adopted during the last, and far into the present, century.

According to the materialists, substances have heat stored up in them. A metal becomes hot when it is hammered because its particles are approximated, and the heat is, as it were, squeezed out of it, as water is squeezed out of a sponge. The metal, before being hammered, was said to possess a *greater capacity for heat* than the hammered metal. In a similar manner they accounted for the production of heat by friction and percussion; the possibility of producing new heat was denied, and the amount in the universe was considered incapable of variation.

In 1798, Count Rumford, while engaged in the boring of cannon in the Arsenal of Munich, observed, with surprise, the large amount of heat which was produced during the process, and the apparently unlimited extent of its production. Now, he reasoned, if the explanation of the materialists be correct, it follows that all the heat observed in the cannon, and in the separated borings, results from the altered capacity for heat of a few ounces of metal borings. But, on examination, they were found to possess precisely the same capacity for heat as an equal weight of the solid metal, hence the explanation offered by the materialists was clearly fallacious. Rumford afterwards constructed a special machine for the production of heat by friction. It consisted of a metal cylinder in which a blunt steel borer was caused to revolve by horse-power. The cylinder was surrounded by a casing, in which was placed about 2½ gallons of water. When the borer was caused to revolve, the temperature of the water gradually rose, until, in two hours and a half, the whole quantity of water commenced to boil—a conclusive proof of the unlimited production of heat by mechanical means. A few years later, Sir Humphry Davy conclusively proved the immateriality of heat, by demonstrating the liquefaction of two pieces of ice submitted to friction in a freezing atmosphere. Now, it was admitted—even by the materialists, who contested every inch of ground—that water possesses more heat than ice at the same temperature, hence, if their explanation were valid, ice ought not to liquefy when submitted to friction in a freezing atmosphere.

Although the fallacy of the material theory was thus proved early in the century, the theory was by no means abandoned, and it continued to be generally adopted (when *any* theory at all of heat was adopted), until it was shown that a definite relationship exists between heat and mechanical work, and that they are mutually convertible. This determination of the so-called *mechanical equivalent of heat* was made almost simultaneously by Dr. Julius

* Some time ago a correspondent enquired in this journal if iron could really be hammered until it becomes red-hot, and some discussion was elicited on the subject, the general conclusion appearing to be that it is one of the many things which are much talked of, but never seen. I recently asked a blacksmith if he could do it, and he replied that he had never seen it done, but would try. In the first place a piece of very tough iron was hammered with a moderately heavy hammer; it became hot, but scarcely sufficiently so to scorch a piece of paper upon which it was placed. It was then hammered by two men, one of whom used a sledge hammer, but the iron scarcely became hotter than before. Presently a man who was working in the shop said he had often lit his forge fire by the means when matches were less plentiful than now, and he accordingly took a nail, such as is used for shoeing horses, and after hammering with a light hammer for less than two minutes, part of the nail was brought to a bright red heat. It thus appears that there is a good deal of knack in the operation; the blows were light but frequent, and the nail was turned at each blow, with something of the alternating motion which is adopted in feathering an oar; that is, if we suppose the nail to be square, it was turned, so as to receive one blow upon a surface A, the second on a contiguous side B, the third on A again, and so on, these two surfaces being struck alternately. A few months ago I saw a heavily laden omnibus rapidly descending Pentonville-hill with a locked wheel; before reaching the bottom of the hill the bearing surface of the locked wheel was glowing with a bright red heat, and the adjacent woodwork was on fire.

Mayer, of Heilbronn, in Wurtemburg, and by Mr. Joule, of Manchester, in the year 1842. Mayer worked out his result rather by reasoning upon known facts than by direct experiment, while Joule instituted a lengthy and elaborate series of experiments, which were published in their entirety in 1850. Since this date, the kinetic theory of heat has been largely developed by the labours of Hirn, Helmholtz, and Sir William Thomson, and notably by Professor Clausius, of Zurich.

Let us now turn our attention to Joule's determination of the relationship existing between heat and mechanical work, or, more correctly, and in accordance with the definition of heat with which we started, of the amount of mass motion equivalent to and convertible into a definite amount of molecular motion. In this country, the unit of mechanical work (known as the *foot-pound*) is the mechanical force necessary to lift 1 lb. to a height of 1 foot *in vacuo*, and the unit of heat is the quantity of heat necessary to raise 1 lb. of water 1° F. in temperature strictly from 55° to 56° F. On the Continent, the unit of work (called a *kilogrammetre*) is the mechanical force necessary to lift 1 kilogramme to a height of 1 metre *in vacuo*, and the unit of heat is the quantity of heat necessary to raise 1 kilogramme of water from 0° C. to 1° C. Sometimes the quantity of heat necessary to raise 1 lb. of water from 0° to 1° C. is adopted as a unit of heat in this country.

Now the simplest and most definite form of mechanical force is the falling of a known weight through a known space under the influence of the force of gravity; and this form of force was employed by Mr. Joule to produce heat by friction. A falling weight was caused to communicate rotary motion to a paddle working respectively in water and in mercury, and to produce the revolution of cast-iron discs in contact; and the increase of temperature resulting from the friction was measured by thermometers which could be read to 1-200th of a degree Fahrenheit. The rise of temperature for each experiment was—in the case of water, 0·563° F.; mercury, 2·41° F.; and cast-iron, 4·3° F.† By this method, Joule ascertained that a weight of 1 lb., falling from a height of 772 feet, produces, on its collision with the earth, an amount of heat competent to raise the temperature of 1 lb. of water 1° F. (that is to say, to generate one unit of heat). Mayer, by a perfectly distinct method, found the number to be 771·4 feet—a difference of less than 0·1 per cent; hence there can be no doubt concerning the accuracy of the determinations.

Let us next consider the various modes by which heat may be generated—the various causes which tend to produce a rapid motion in the molecules of matter; and this brings us at once to the subject of *energy*.

Energy (*ενεργεια*, action, operation) is a term used in physics to designate the power of doing work against or overcoming the action of force, whether it be—(*α*) the attraction of masses acting through a sensible space (*gravity*); (*β*) the attraction of similar molecules acting through an insensible space (*cohesion*); (*γ*) the attraction of dissimilar molecules acting through an insensible space (*chemical affinity*); (*δ*) the attraction of molecules in different electrical or magnetic conditions (*electrical and magnetic attraction*), or any action whatsoever which it may be possible to resist. In fact, we may attach to the term energy almost the same meaning as it possesses when applied to ourselves. Energy is competent to exist in two conditions; viz., as *potential energy*, or possible energy; and as *kinetic energy*, or actual energy; and these may be likened to energy of character, and to energy of action in ourselves.

Potential energy, or energy of position, or possible energy, or, as Helmholtz calls it, energy of tension, is energy existing in possibility, not in act, as in the case of a ball suspended above the surface of the earth, or an arrow resting upon a tense bow-string.

Kinetic energy, or energy of motion, or dynamic energy, or *vis viva*, or mechanical energy (for by these various names you will find it designated in different books), is the actual energy of a body in motion; as in the case of a ball falling to the earth's surface, or an arrow projected from a released bow-string.

Now, when the kinetic energy of a mass is suddenly arrested—as by collision with a larger mass—it is transformed into the motion of molecules—it becomes heat; and it has been found that the heat thus produced is dependent upon the mass of the moving body multiplied by the square of its velocity, that is, $h = mv^2$. From this, it follows that, if the velocity of a projectile be doubled, the heat developed on the stoppage of its motion will be increased fourfold; if trebled, ninefold; if quadrupled, sixteenfold; and so on. It has thus been calculated that a rifle-bullet, moving with a velocity of 1338 feet per second, develops, upon striking the target, sufficient heat to raise its temperature 1080° F., an amount more than sufficient to fuse it; but we must remember that this heat is shared between the bullet and the target. But, in the application of this law, we may pass from the arrested motion of a rifle-bullet to that of far larger masses of matter. Mayer and Helmholtz have calculated the amount of heat which would be produced by the stoppage of the earth in its orbit, and have determined that it would be sufficient not alone to fuse, but actually to vaporise the earth. The heat thus generated would be equal to that produced by the burning of fourteen spheres of coal, each equal to the earth in magnitude.

The amount of energy in the Universe is constant; we can neither add to it nor take from it; the only possible change is from one form to another; and this is called the principle of the *conservation of energy*.

Potential energy is constantly being converted into kinetic energy, and kinetic energy as constantly into heat. Friction, percussion, and compression, and the partial or complete stoppage of motion in any form, and by any means whatsoever, afford examples of this. (I.)—*By Friction.*—Lucretius tells us that fire was first made known to mortals, either by clouds meeting violently in collision and dashing out sparks of fire, or by the excessive friction of the branches of trees in a forest, induced by high winds, and resulting in fire. Friction has, from the earliest ages, been employed as a means of producing fire, and in our modern matches, although the labour is lessened, we still adopt the means. (The many experiments which illustrate this part of the subject are too well known to need detail here. Phosphorus may be readily ignited by the heat of friction (*α*) of a pointed piece of wood rubbed in a wooden groove; (*β*) of a gimlet which has been used for boring wood, or (*γ*) of a saw which has been used for sawing; (*δ*) by the heat resulting from the friction of the crystalline fibres of tin, by bending a rod of that metal repeatedly in opposite directions; and a number of examples will suggest themselves at once without further mention.) (II.)—*By Percussion.*—A piece of metal when hammered becomes hot, and may readily be brought to a red heat. When a pistol is cocked, potential energy is conferred upon the hammer; it is comparable to a raised weight: when the trigger is pulled, the potential energy becomes kinetic; when the hammer strikes the cap the kinetic energy becomes heat equal to that expended in raising the hammer. (III.) *By Compression.*—A piece of wood, compressed in an hydraulic press, becomes warmer than before. In the rolling of the metals (as at the Mint), the bar, before passing between the rollers, is cold, but, after compression, it comes out so intensely heated that water assumes the spheroidal condition when poured upon it.

† If water be violently shaken in a bottle for less than a minute, a rise of temperature of from 0·7 to 0·8 F. ensues; and, in the case of mercury, of from 1·3° to 1·5 F. Of course, in both cases, if the bottles are shaken by the hand, they must be surrounded by several layers of thick flannel, to prevent any communication of heat from the hand. Mr. Herschell has ingeniously shown the heating of mercury by agitation by communicating rapid reciprocal motion to a tube containing a small quantity of that metal, and then placing a piece of phosphorus on its surface: immediate ignition is the result.

ment the hydrogenium is in the proportion of 0·3151 to 100 palladium and gold together. This gives 0·3939 hydrogenium to 100 palladium; while a whole equivalent of hydrogenium is 0·939 to 100 palladium.* The hydrogenium found is, by calculation, 0·4195 equivalent, or one equivalent hydrogenium to 2·383 equivalents palladium, which comes nearer to two equivalents of the former with five of the latter than to any other proportion.

To ascertain the smallest proportion of gold which prevents retraction, an alloy was made by fusing seven parts of that metal with 93 parts of palladium, which had a specific gravity of 13·05. The button was rolled into a thin strip and charged with hydrogen by the wet method. An occlusion of 585·44 volumes of gas took place, with a linear expansion of 1·7 on 100. A retraction followed to nearly the same extent on afterwards expelling the hydrogen by heat.

With another alloy, produced by fusing 10 of gold with 90 of palladium, the occlusion of gas was 475 volumes, the linear expansion 1·65 on 100. The retraction on expelling the gas afterwards was extremely slight. To nullify the retraction of the palladium, about 10 per cent of gold appears therefore to be required in the alloy.

Another alloy of palladium of sp. gr. 13·1, and containing 14·79 per cent of gold, underwent no retraction on losing hydrogen, as already stated.

The presence of so much gold in the alloy as half its weight did not materially reduce the occluding power of the palladium. Such an alloy was capable of holding 459·9 times its volume of hydrogen, with a linear expansion of 1·67 per cent.

3. *Palladium, Silver, and Hydrogenium.*—The occluding power of palladium appeared to be entirely lost when that metal was alloyed with much more than its own weight of any fixed metal. Palladium alloys containing 80, 75, and 70 per cent of silver, occluded no hydrogen whatever.

With about 50 per cent of silver, palladium rolled into a thin strip occluded 400·6 volumes of hydrogen. It expanded 1·64 part in 100 in length, and returned to its original dimensions without retraction upon the expulsion of the gas. The specific gravity of this silver-palladium alloy was 11·8; the density of the hydrogenium 0·727.

An alloy, which was formed of 66 parts of palladium and 34 parts of silver, had the specific gravity 11·45. It was drawn into wire, and found to absorb 511·37 volumes of hydrogen. The length of the wire increased from 609·601 to 619·532 m.m. This is a linear elongation of 1·629 on 100, or cubic expansion of 4·97 on 100. The weight of the wire was 3·483 grms.; its volume 0·3041 c.c. The absolute volume of occluded hydrogen was 125·1 c.c., of which the weight is 0·01120896. The volume of the hydrogenium was 0·015105 c.c. The resulting density of hydrogenium is 0·742.

In a repetition of the experiment upon another portion of the same wire, 407·7 volumes of hydrogen were occluded, and the wire increased in length from 609·601 m.m. to 619·44 m.m. This is a linear expansion of 1·614 part on 100, and a cubic expansion of 4·92 on 100. The absolute volume of hydrogen gas occluded was 124·0 c.c., and its calculated weight 0·01111 grm. The volume of the hydrogenium being 0·1496 c.c., the density of hydrogenium indicated is 0·741. The two experiments are, indeed, almost identical. The wire returned in both experiments to its original length exactly after the extraction of the gas.

4. *Palladium, Nickel, and Hydrogenium.*—The alloy, consisting of equal parts of palladium and nickel, was white, hard, and readily extensible. Its specific gravity was 11·22. This alloy occluded 69·76 volumes of hydrogen, with a linear expansion of 0·2 per cent. It suffered no retraction below its normal length on the expulsion of the gas by heat.

An alloy of equal parts of *bismuth* and palladium was a brittle mass that did not admit of being rolled. It occluded no hydrogen, after exposure to that gas as the negative electrode, in an acid fluid for a period of 18 hours. It seems probable that malleability and the colloid character, which are wanting in this bismuth alloy, are essential to the occlusion of hydrogen by a palladium alloy.

An alloy of one part of *copper* and six parts of palladium proved moderately extensible, but absorbed no sensible amount of hydrogen. The metallic laminæ which remain on digesting this alloy in hydrochloric acid, and which were found by M. Debray to be a definite alloy of palladium and copper (PdCu), exhibited no sensible occluding power.

The conclusions suggested as to the density of hydrogenium, by the compound with palladium alone and by the compounds with palladium alloys, are as follows:—

	Density of Hydrogenium observed.
When united with palladium	0·8540 to 0·8720
When united with palladium and platinum	0·7401 to 0·7545
When united with palladium and gold ..	0·7110 to 0·7150
When united with palladium and silver..	0·7270 to 0·7420

The results, it will be observed, are most uniform with the compound alloys, in which retraction is avoided, and they lie between 0·711 and 0·7545. It may be argued that hydrogenium is likely to be condensed somewhat in combination, and that consequently the smallest number (0·711) is likely to be the nearest to the truth. But the mean of the two extreme numbers will probably be admitted as a more legitimate deduction from the experiments on the compounds alloys, and 0·733 be accepted provisionally as the approximate density of hydrogenium.

I have the pleasure to repeat my acknowledgments to Mr. W. C. Roberts for his valuable assistance in this inquiry.

* H = 1; Pd = 106·5.

ON CRYSTALS INCLOSED IN BLOWPIPE BEADS.

By H. C. SORBY, F.R.S., &c.

At the *soirée* of the Royal Society on March 6, by the kind assistance of my friend Mr. Wm. Baker, I exhibited a number of blowpipe beads inclosing various crystals of such extreme beauty as mere microscopical objects, that probably some account of them may be interesting, independently of their connection with chemistry and mineralogy.

It has long deen known that blowpipe beads often become opaque on flaming; and Emerson* showed that, by proper manipulation, well-formed crystals can be produced in them, and recognised by their characteristic forms when magnified. Rose† described very interesting results thus obtained in the case of titanic acid; and Captain Ross has published several papers in the CHEMICAL NEWS,‡ in which he gives the results obtained by blowing out the beads into thin vesicles, exhibiting minute characteristic crystals. My method differs materially from those described by the above-named authors. I use borax as the solvent, and, if requisite, add various reagents to produce, as it were, precipitates of characteristic crystalline form. By keeping the supersaturated fused beads over the flame, crystals may be obtained in cases where, according to Emerson nothing satisfactory results from mere flaming; and the addition of various reagents adds greatly to our resources in the cases of earths variously mixed or combined with mineral acids. It is not my intention to enter now into the purely chemical part of the subject, or to show its application to mineralogy. I shall merely give a short account of some specimens thus prepared, which may be of interest as microscopical objects of remarkable character. Many are good illustrations of the manner in which crystals grow up from the simple nuclei to compli-

* *Proceedings of the American Academy*, 1866, vol. vi., p. 470.
† *Berlin Acad. Bericht*, 1867, pp. 129, 450.
‡ Vol. xvi., p. 370; vol. xvii., pp. 55, 63, 82, 87, and 107.

cated forms of extreme beauty; and it is very instructive to see how the definite secondary planes of the crystals, viewed as a whole, are produced by the regularly graduated growth of numerous small crystals symmetrically deposited. This is sometimes so striking as to lead me to hope that further study may throw important light on the cause of the production of secondary crystalline forms.

In preparing the specimens, so much of the substance must be added to the borax that it entirely dissolves at a high temperature, but is partially deposited when kept for some time at a heat below dull redness. The beads should be about ¼ inch in diameter, and one-third that thickness. The loop in the platinum wire can easily be made circular by bending it round a glass rod. I need scarcely say that no one ought to expect to obtain good specimens at first. Much depends on that sort of manipulation which is easier to learn by experience than explain by writing.

The most useful object-glass is a 4-10 inch, of small aperture, made to adjust for looking through thick glass, so that crystals may be distinctly seen in the interior of the beads. When no condenser is used, the double convex form of the beads prevents our seeing more than a small portion of the interior; but by using as a condenser a plano-convex lens, of about ¼ inch diameter and ¼ inch focal length, nearly the whole bead is illuminated, without the definition being materially injured; and even this may be overcome by properly regulating the distance of the condenser, and the size of the aperture below it. The full beauty of the specimens can only be seen with a binocular microscope, and few objects are better fitted to show the advantage of that kind of instrument. The crystals then stand out in perfect relief, and are seen to be equally complicated in all directions. It must not be thought that in each case all the crystals are alike. Those formed on the surface differ much from those in the interior of the beads; and in both positions, though the type is constant, the forms vary very considerably.

After having obtained crystals of satisfactory character, if it be desirable to keep the specimen as a permanent object, the ring-shaped loop and inclosed bead should be cut off and mounted in a cell with Canada balsam. This is requisite, since the moisture of the atmosphere causes the borax to become hydrated and opaque; but, when properly mounted in balsam, it alters so slowly that I have not remarked any change for half a year. When thus mounted, the curved form of the beads almost ceases to be any impediment in examining crystals in the interior, and an ordinary achromatic condenser of long focal length may be used with advantage; but in some cases crystals on the surface are much less distinct than when the beads are not mounted.

Few objects of the kind are more easily prepared than the crystals of borate of magnesia deposited from borax saturated with magnesia. They first form as thin prisms, and smaller crystals are afterwards deposited, so as to give rise to objects very much like a handle with a brush at each end.

Zircon or zirconia fused with borax yields crystals of the borate. In their most rudimentary state they are small prisms with a simple cross at each end, which afterwards becomes complicated.

The crystals of molybdate of zirconia formed by fusing zirconia in borax with molybdic acid, are extremely elegant and beautiful objects. They are so delicate that their own weight would probably break them, if they were in an aqueous solution; but being supported in solid borax, like the insects inclosed in amber, they are secure from all injury.

Scheelite—native tunsgate of lime—fused in borax is deposited in crystals of great beauty, and is an object easily prepared.

The molybdate of strontia, produced by fusing strontia and molybdic acid in borax, crystallises in long spindle-shaped crystals, whereas the molybdate of lime yields very different crystals, of a form intermediate between that of molybdate of zirconia and scheelite.

Apatite—native phosphate of lime—fused with borax, deposits in crystals which vary much in shape. Six-sided stars are often formed on the surface, and needle-shaped crystals grow from their centres into the interior of the borax, so that they look like nails with highly-ornamental heads driven down into the bead. When formed with their axis parallel to the surface, the crystals are sometimes much like *diatomaceæ*. The addition of phosphate of soda to a borax bead containing lime in almost any state of combination gives rise to similar crystals.

On adding a certain amount of carbonate of soda to quartz or various silicates dissolved in borax, crystals are deposited, which vary much according to circumstances; but they all seem to be due to the variable growth of many small six-sided prisms with expanded ends. Sometimes they have a curious dice-box form, resulting from a bundle of such crystals. Probably such are some silicate of soda, modified by the presence of other bases.

Titanic acid gives hair-like prisms variously grouped. Molybdic acid is sometimes set free as liquid globules, which coalesce, rise to the surface, and afterwards solidify as small spheres.

These few examples will, at all events, serve to show that the crystals deposited in blowpipe beads are of considerable interest, merely as beautiful microscopical objects. I should, however, be very sorry if any one were to imagine that I considered this their chief merit. On another occasion my aim will be to prove that this method may be employed with great advantage in determining the nature of minerals and chemical precipipates, when so small a quantity can be procured that other methods would almost or entirely fail to give satisfactory results.—*Monthly Microscopical Journal.*

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

July 1st, 1869.

Dr. A. W. WILLIAMSON, F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The PRESIDENT stated that, as the meeting was an extraordinary one, the routine business would be dispensed with.

A written communication from Dr. Mills, on the subject of "*The Atomic Theory*," was read. No discussion followed, but the President said he should feel honoured if, after seeing in print what he himself had put together on the subject, they thought it worth while to go into the question some evening.

A paper by Mr. H. Smith, F.C.S., "*On Ethyl Hyposulphurous Acid*," was then read.

The author prepared ethylic sulphide by placing protosulphide of potassium in a retort with ordinary alcohol, passing the vapour of ethylic chloride into the liquid, and then applying heat, when a distillate, containing ethylic sulphide, alcohol, and ethylic chloride, came over. Water was added, and the oil which separated re-distilled. After rectification with calcium chloride, it had a constant boiling point at 81° C.

Ethylic sulphide was treated with an equal bulk of strong sulphuric acid, a large quantity of water added, and the whole neutralised with pure barium carbonate, the resulting solution of barium ethy-hyposulphite evaporated to one-third of its bulk, and set aside to crystallise. The author has also prepared the copper, silver, and sodium salts.

The PRESIDENT remarked that, according to the formula given by Mr. Smith, half of the [illegible]ry hypo-

sulphites was replaced by ethyl, and it was merely analogous in its constitution to a sulphate. It did not, as far as he could see, bear in any direct way on the question of the constitution of the hyposulphites, which occupied their attention a few meetings since.

Mr. PERKIN wrote the following formula on the board:—Barium salt—$(C_2H_5)_2BaS_4O_6+2H_2O$. The sodium salt would, therefore, be:—$C_2H_5NaS_2O_3+H_2O$.

The PRESIDENT remarked that the constitutional water was still undisturbed.

A paper by Dr. Phipson, "*On the Absorption Spectra of Certain Organic Substances*," was then read. The author had found that cyanine gave an absorption spectra resembling that of mauve. He also found that the colours of certain flowers gave absorption bands in the spectrum.

Mr. MCLEOD then explained "*An Apparatus for the Determination of Gases Dissolved in Natural Waters.*" The water is measured in a graduated pipette into which it is introduced without coming in contact with air, mercury being drawn from the bottom of the pipette, while a narrow tube connected with the upper part of the measure is passed to the bottom of the bottle containing the water. The water is then allowed to flow into the lower of two globes connected by a narrow glass tube, and in which a Torricellian vacuum has been produced. The lower globe stands in a water-bath heated to 50°, and the water is allowed to remain at that temperature for about 30 minutes. During this time almost the whole quantities of the nitrogen and oxygen dissolved in the water are evolved together with some carbonic anhydride. Mercury is then allowed to rise from a reservoir into the bulbs, and the gas, which has been evolved, removed by means of a Sprengel's mercurial pump, through a stop-cock at the top of the upper globe. After this, the mercury is run out from the globes and the water-bath more strongly heated, a slow current of cold water being allowed to trickle over the upper bulb. By this means the water is distilled *in vacuo*, and the gases remaining, which consist almost exclusively of carbonic anhydride, are eliminated from the water. These gases are then removed, as before, from the apparatus, by means of the Sprengel and analysed.

It was found necessary to resort to the process of distillation in order to decompose the soluble acid calcic carbonate; as some of this compound remained unaltered, even when maintained for two hours at a temperature of 105°—109° in a salt water bath. The following results were obtained from 100 c.c. of a sample of tap water drawn from the cistern of the Royal College of Chemistry.

I.

	Gas evolved at 50°.	Gas evolved on distillation.	Total.
	c.c.	c.c.	c.c.
N	1·3906	0·0067	1·3973
O	0·6093	0·0113	0·6206
CO_2	0·4199	3·8769	4·2968
	2·4198	3·8949	6·3147

II.

	Gas evolved at 50°.	Gas evolved on distillation.	Total.
	c.c.	c.c.	c.c.
N	1·3956	0·0022	1·3978
O	0·6057	0·0135	0·6192
CO_2	0·4990	3·6809	4·1799
	2·5003	3·6966	6·1969

The mercurial pump employed in these experiments is slightly modified from that originally described by Dr. Sprengel, in the *Journal of the Chemical Society*, though in the three experiments which have been tried, the results have not nearly equalled those described in his paper. Dr. Sprengel obtained a residue of air in an exhausted receiver equal to 1-1,300,000th of the original quantity: the best result obtained in the above-mentioned experiments being only 1-516,666th. By means of this apparatus, however, Dr. Frankland and Mr. Lockyer have rarefied perfectly dry oxygen, nitrogen, and hydrogen to such an extent, that their resistance was equal to that of atmospheric air at the ordinary pressure. The quantity of carbonic anhydride in carbonates may be determined in the form of gas, as first suggested by Dr. Russell, the Sprengel being employed for removing the gas from the valve in which the carbonates are decomposed. For this purpose a weighed quantity of the carbonate is placed in a small glass tube, which is then introduced into a wide perpendicular tube about 900 m.m. in length, and provided with a stop-cock at the upper end. The lower orifice is placed under mercury, and the air removed by means of the Sprengel. Dilute sulphuric or hydrochloric acid is passed up the tube, and the carbonic anhydride which is evolved removed and measured. In two experiments, the quantities of carbonic anhydride evolved from white marble were 43·72 and 43·61 per cent.

"*A New Form of Apparatus for Gas Analysis.*"—This is a modification of the apparatus described some years ago by Dr. Frankland and Mr. Ward. It consists of two tubes, one about 5 and the other about 20 m.m. in diameter. These tubes are, respectively 1100 and 900 m.m. long. They are surrounded by a cylinder, through which a constant stream of water flows, and communicate with one another, just below the wide cylinder, by means of a caoutchouc joint surrounded by calico. The lower end of the narrow tube is also connected, in a similar manner, with a tube provided with a stop-cock, and which descends 900 m.m. below the joint, and communicates, by means of a long flexible tube surrounded with calico, to a reservoir containing mercury, which is so suspended that it can be raised above the level of the top of the apparatus. The narrower tube is graduated in millimetres from the bottom to the top, the upper end being closed by a glass stop-cock. The wide tube is marked with divisions at every 100 m.m., the contents of each division being determined. This tube is provided with wires, and closed at the upper end by a capillary tube and glass stop-cock, with a steel cap, by means of which it may be attached to a short and wide laboratory tube, such as is used in the apparatus described by Dr. Frankland in the *Journal of the Chemical Society*, 2nd series, vol. vi., p. 109. The analysis of gases is performed with this apparatus in the same manner as with the original one of Frankland and Ward, the measurements being made by determining the temperature and tension of fixed volumes of gas. The absorptions are performed in the laboratory tube, and explosions in the measuring tube. The whole apparatus may be easily worked with 900 c.c. of mercury, and the results obtained are very satisfactory.

Dr. RUSSELL read a paper entitled. "*Further Experiments on the Atomic Weights of Cobalt and Nickel.*"

In 1863, the author published an account of researches on the determination of the atomic weights of cobalt and nickel by the reduction of the oxide by hydrogen, when he found the atomic weights of cobalt and nickel to be 29·37. Since then, experiments had been made by two other chemists, Sommannga and Winkler, the former of whom gave 29·99 for the atomic weight of cobalt, and 29·01 for nickel, while Winkler's determinations showed cobalt to be 29·49, and nickel, 29·53. More recently, Dr. Schneider, in a paper to *Poggendorff's Annalen*, called attention to the fact that Sommannga's determination of the atomic weights almost coincided with the numbers he had previously obtained, and endeavoured to explain why Dr. Russell's numbers differed from his own. The author had lately experimented with the same cobalt and nickel used before, and determined the atomic weights from the volume of hydrogen evolved when a known weight of the metal was dissolved in hydrochloric acid, and the results fully confirmed the accuracy of his former experiments. The mean of four experiments by the reduction of the oxides determined the atomic weights of both nickel and cobalt

to be 29·37; the mean of four experiments from the volume of hydrogen evolved was 29·38 for each metal.

The President thought it a most admirable confirmation of the conclusion arrived at by different methods, that numbers so very nearly coincident with these should be obtained by this process, and it was satisfactory that the result was established by concurrent evidence of very different kinds.

Professor Wanklyn said that the experiments related by Dr. Russell were particularly interesting to him, as they confirmed the views expressed by himself and Mr. Chapman about the hydrogen process.

After a verbal communication "*On the Action of Phosphoric Chloride on Oil of Vitriol*," by the Rev. Mr. Williams, the meeting was adjourned till the next session.

CORRESPONDENCE.

GASEOUS SPECTRA.

To the Editor of the Chemical News.

Sir,—In the paper on "Researches on Gaseous Spectra in relation to the Physical Constitution of the Sun, Stars, and Nebulæ," by Dr. Frankland and Mr. Lockyer, as reported by you, the authors do not notice similar observations which I presented to the Royal Society in April, 1868. I send you the following extracts from that paper, which is printed in the *Phil. Trans.* for 1868.—I am, &c.,

William Huggins.

"The following observations are suggestive in connexion with the point under consideration. Electrodes of platinum were placed before the object-glass in the direction of a diameter, so that the spark was as nearly as possible before the centre of the lens. The spark was taken in air. I expected to find the spectrum faint, for the reasons which have been stated in a previous paragraph (the diminution of the brightness of the spark from the distance at which it is placed from the slit), but I was surprised to find that only one line was visible in the large spectroscope when adapted to the eye-end of the telescope. This line was the one which agrees in position with the line in the nebula, so that under these circumstances the spectrum of nitrogen appeared precisely similar to the spectra of those nebulæ, of which the light is apparently monochromatic. This resemblance was made more complete by the faintness of the line; from which cause it appeared much narrower, and the separate existence of its two components could no longer be detected. When this line was observed simultaneously with that in the nebula, it was found to appear but a very little broader than that line. When the battery circuit was completed, the line from the spark coincided so accurately in position with the nebular line, that the effect to the eye was as if a sudden increase of brightness in the line of the nebula had taken place. In order to make this observation, and to compare the relative appearance of the lines, the telescope was moved so that the light from the nebula occupied the lower half only of the slit. The line of the spark was now seen to be a very little broader than the line of the nebula, and appeared as a continuation of it in an unbroken straight line. These observations were repeated many times on several nights."—(P. 542.)

"The double line in the nitrogen-spectrum does not consist of sharply defined lines, but each component is nebulous, and remains of a greater width than the image of the slit.* The breadth of these lines appears to be connected with the conditions of tension and of temperature of the gas. Plücker* states that when an induction-spark of great heating power is employed, the lines expand so as to unite and form an undivided band. Even when the duplicity exists, the eye ceases to have the power to distinguish the component lines, if the intensity of the light be greatly diminished.

"Though I have been unable to detect duplicity in the corresponding line in the nebula, it might possibly be found to be double if seen under more favourable conditions; I incline to the belief that it is not double.†

"In my tables of the lines of the air‡ I estimated the brightness of each of the components of the double line in the spectrum of nitrogen at 10, and the components of the double line next in brightness in the orange at 7 and 5, and those of a third double line on the less refrangible side of D at 6 and 4. It was with reference to these two double lines next in apparent brilliancy that I wrote,‖ in speaking of the line in the nebula, 'If, however, this line were due to nitrogen, we ought to see other lines as well; for there are specially two strong double lines in the spectrum of nitrogen, one at least of which, if they existed in the light of the nebulæ, would be easily visible.'

"As the disappearance of the whole spectrum of nitrogen, with the exception of the one double line, was unexpected, though, indeed, in accordance with my previous estimations, I examined the spectrum of nitrogen with a spectroscope furnished with one prism with a refracting angle of 60°, in which the whole of the spectrum from C to G is included in the field of view. I then moved between the eye and the little telescope of the spectroscope a wedge of neutral-tint glass corrected for refraction by an inverted similar wedge of crown glass, and which I had found to be sensibly equal in absorbing power on the different parts of the visible spectrum. As the darker part of the wedge was brought before the eye, the two groups in the orange were quite extinguished, while the lines in the green still remained of considerable brightness. The line which under these circumstances remained longest visible next to the brightest line, was one more refrangible at 2669 of the scale of my map. This observation was made with a narrow slit. When the induction spark was looked at from a distance of some feet with a direct-vision prism held close to the eye, I was surprised to observe that the double line in the orange appeared to me to be the brightest in the spectrum, and when the neutral-tint wedge was interposed, this line in the orange remained alone visible, all the other lines being extinguished.

"When, however, in place of the simple prism a small direct-vision spectroscope provided with a slit was employed, I found it to be possible, by receding from the spark, to find a position in which the double line in the green, with which the line in the nebula coincides, was alone visible, and the spectrum of the spark in nitrogen resembled that of a monochromatic nebula.

"It is obvious that if the spectrum of hydrogen were reduced in intensity, the line in the blue, which corresponds to that in the nebula, would remain visible after the line in the red and the lines more refrangible than F had become too feeble to affect the eye.

"It therefore becomes a question of much interest whether the one, two, three, or four lines seen in the spectra of these nebulæ represent the whole of the light emitted by these bodies, or whether these lines are the strongest lines only of their spectra which, by reason of their greater intensity, have succeeded in reaching the earth. Since these nebulæ are bodies which have a sensible diameter, and in all probability present a continuous luminous surface, or nearly so, we cannot suppose that any lines have been extinguished by the effect of the distance of these objects from us.

* Secchi states that with his direct spectroscope this line in the annular nebula in Lyra appears double. As the image of the nebula is viewed directly, after elongation by the cylindrical lens, and without a slit, it is probable that the two lines may correspond to the two sides of the elongated annulus of the nebula.

* *Philosophical Transactions*, 1863, p. 13.

† "On the Spectra of the Chemical Elements," *Philosophical Transactions*, 1864, p. 141.

‡ Ibid.

‖ Ibid, p. 443

"If we had evidence that the other lines which present themselves in the spectra of nitrogen and hydrogen were quenched on their way to us we should have to consider their disappearance as an indication of a power of extinction residing in cosmical space, similar to that which was suggested from theoretical considerations by Chéseaux, and was afterwards supported on other grounds by Olbers and the elder Struve. Further, as the lines which we see in the nebulæ are precisely those which experiment shows would longest resist extinction, at least so far as respects their power of producing an impression on our visual organs, we might conclude that this absorptive property of space is not *elective* in its action on light, but is of the character of a *general* absorption acting equally, or nearly so, on light of every degree of refrangibility. Whatever may be the true state of the case, the result of this re-examination of the spectrum of this nebula appears to give increased probability to the suggestion that followed from my former observations, namely, that the substances hydrogen and nitrogen are the principle constituents of the nebulæ of the class under consideration."—(Pp. 543—544.)

MISCELLANEOUS.

Royal School of Mines.—At a meeting of the Council on Saturday, the 3rd inst., the results of the examinations for the past session were declared. The following gentlemen, having passed the requisite examinations, have obtained the title of "Associate of the Royal School of Mines" in the divisions mentioned:—Bell, Metallurgical; G. Broome, Mining and Metallurgical; L. Brown, Metallurgical; — Butler, Geological; R. J. Frecheville, Metallurgical; G. Green, Metallurgical and Geological; M. F. Maury, Mining and Metallurgical; F. J. M. Page, Mining and Metallurgical; — Tayler, Metallurgical. The following prizes and scholarships were awarded:—Two Royal Exhibitions of £15 for first year students—(1) J. J. Bowrey; (2) W. Gowland. H.R.H. The Duke of Cornwall's Scholarship, £30 for two years—W. J. Sollas. Royal Exhibition of £25 for second year students—W. Gowland. De la Beche Medal and Books, for Mining—G. Broome. The Director's (Sir Rod. I. Murchison's) prize for Geology—W. Gowland.

Inexhaustible Manures.—In the Atlantic Ocean, a little to the west of the Azores, there exists a space seven times larger than all Germany, according to the late A. von Humboldt, completely covered with a dense mass of vegetation, the so-called Sargasso Sea. M. J. Lavinière has proposed to the Société d'Agriculture to make these floating meadows, as they are called by Aviedo, subservient to the purposes of agriculture. His suggestion is that the ships occupied during the summer in cod-fishing should, in other seasons, be employed in conveying this abundant and excellent manure to the Azores, where an *entrepôt* could be established, the weeds pressed and dried, and the salts they contain extracted. Analysis has shown that these weeds possess the same fertilising properties as those employed as manure on the French coasts. M. Laviniere calculates that these floating meadows produce annually sufficient vegetable matter to manure 600,000,000 hectares, a hectare being about an acre and a half.—*Revista Industrial, &c.*

Pink Colour and Mineral Lake.—Under the name of pink colour there is met with in the trade, and manufactured by a process which is kept secret, a substance which is chiefly used in this country for painting faience and porcelain. According to M. Malaguti's analysis, this substance is composed, in 100 parts, of—Peroxide of tin, or stannic acid, 78·31; lime, 14·91; silica, 3·96; alumina, 0·95; oxide of chromium, 0·52; chromate of potassa, 0·26; potassa and loss, 0·48. The stannic acid, lime, and oxide of chromium are the essential elements; the silica and alumina are not indispensable; the richness and depth of the colour depends upon the larger quantity of lime and chromate applied in the manufacture. According to M. Gentele, this pink colour may be prepared in the following manner:—1 kilo. of granulated tin is oxidised with nitric acid, the meta-stannic acid thus obtained is mixed with 150 grms. of bichromate of potassa dissolved in 1 litre of water, and to this mixture there are added 2 kilos. of chalk and 1 kilo. of finely pulverised glass-sand; these materials are made into a paste, and strongly ignited, after having been placed in a crucible, to a bright red heat; the result of this calcination is ground to an impalpably fine powder, and again ignited, with the addition of carbonate of soda. When a mixture of 100 parts of stannic acid and 2 parts of oxide of chromium is ignited to a bright red heat a beautiful lilac-coloured material is obtained, which is neither injured by daylight nor atmospheric influences, resists the action of sulphuretted hydrogen, and is called by M Malaguti "mineral lake."

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences (No. 26), June 28, 1869.

We observe, in the first place, that Sir Roderick Murchison was present at this meeting of the illustrious scientific society of France, of which he has been elected a Foreign Member; being present for the first time after his election, he was most heartily received by the large number of *savants* present. The speech made by the celebrated British geologist was the signal for M. Dumas to say a few words, highly eulogising the excellent reception given to him while lately at London, and stating that, in the person of one of their perpetual secretaries, the British scientific world and renowned *savants* had honoured and féted the Academy. We notice the following papers:—

Mode of Condensing Magnetism Analogous to the Condensation of Electricity.—M. Jamin.—The author has caused M. Limet to make for him a horseshoe-shaped magnet, made up of ten bars of perfectly homogeneous steel, and fastened together by means of bolts. When this artificial magnet is properly magnetised, it is capable of bearing a weight of 300 kilos. at the armatures. When this armature is placed so as to be only in contact with one of the steel bars composing the horseshoe, it appears that the magnetism of the nine other bars is very perceptibly diminished. Under these conditions, and, notwithstanding the magnet was previously already saturated with magnetism, it is possible to saturate anew with magnetism, and make the horseshoe bear again 600 kilos. This experiment can be repeated: another armature may be put on, so as to bear only upon one of the component bars, and, again, more magnetism can be condensed. The learned author has already succeeded in making the horseshoe bear another 680 kilos. in this manner.

Researches on the Oxygenated Bases—Action of Chlorhydric Glycol on Toluidine.—M. Wurtz.—This is another instalment of the papers resulting from the author's labours on this subject. The paper here alluded to contains researches on the action of chlorhydric glycol upon aniline and toluidine. When a mixture of aniline and chlorhydric glycol are heated together on a water-bath, a thickish and coloured liquid is obtained, which yields, with a concentrated solution of chloride of platinum, a very unstable, readily-decomposable salt. When the mixture of substances just alluded to is heated in an air-bath to from 195° to 210°, and the fluid afterwards treated with water, and filtered, an abundant precipitate is formed with a concentrated solution of chloride of platinum. This salt, having been well purified, yields, on analysis, results leading to the formula—

$$(C_{18}H_{16}ON.Cl)_2PtCl_4.$$

When toluidine is thus acted upon by chlorhydric glycol, the author obtains three bases—(*a*) vinyltoluidine—

$$C_9H_{11}N = \begin{matrix} C_7H_7 \\ C_2H_3 \\ H \end{matrix} \Big\} N;$$

(*b*) two other bases of complex composition, containing no longer toluyl, but the radical C_7H_6, toluenyl; while one of these bases contains, besides toluenyl, also two vinylic groups.

New Researches on Hydrogenium.—Mr. T. Graham.—From this paper we quote, in the first place, that the author finds the specific gravity of hydrogenium to be 0·872. The eminent *savant* records in this paper, consecutively, researches on—*palladium, platinum, and hydrogenium; palladium, gold, and hydrogenium; palladium, silver, and hydrogenium; palladium, nickel, and hydrogenium.* We give these researches in a separate paper on another page.

Poisonous Effects of Coralline.—M. Landrin.—This paper, or report, rather, contains the results of the researches made at the request of the celebrated Dr. Tardieu, and the members of the Academy of Medicine. The result of carefully-made experiments, also by giving large doses of coralline to animals and applying it to their skin, is that coralline is no poison at all, whether internally or externally applied; and its use in dyeing is quite harmless, provided it be not mixed with substances which are very decided poisons.

Certain Stellar Spectra.—M. Janssen, in a letter dated from Darjeeling, Sikim, British India, 22nd May last, says that the spectra of some stars, which are rather ruddy-coloured when not disclosing the presence of hydrogen, do positively disclose the presence of aqueous vapour.

Spectra which some Compound Substances Exhibit when Produced within Gaseous Mixtures which are in a state of Equilibrium.—Messrs. Berthelot and Richenau.—This paper is not suited for proper abstraction.

Presence of Peroxide of Hydrogen in the Atmosphere.—M. Struve.—The author, writing from Tiflis (a large town on the Caucasian side of Russia), calls attention to some interesting facts observed by him in reference to the quantity of nitrite of ammonia, ozone, and oxygenated water (peroxide of hydrogen) present in rain-water, and water obtained from melting snow and hail. The author applies oxide of lead as a test, which is converted into peroxide. M. Sainte-Claire Deville reminded the meeting that, while—in July and August, 1859—he was engaged in making some researches (he was, during that time, staying on the St. Bernard); on ascending two mountain tops, named Le Velan and Le Combin, respectively 3762 and 4430 metres high, he collected there rain and snow water, which, on being analysed by M. Boussingault, was found to contain so much ammonia and nitric acid that, were it not that several bottles of the same sample were taken, it might have appeared as if bottles which were not well cleaned had been applied for collecting the fluids.

Heat of Combination of Hydrosulphuric and Hydroselenic Acids.—M. Hautefeuille.—This paper is too abstruse for condensation.

Theory of Etherification by means of Hydrochloric Acid.—M. Friedel.—When it is desired to obtain a compound ether, the mode of obtaining it often resorted to is, to mix the acid of which it is desired to have the ether with alcohol, and to pass through this mixture a current of hydrochloric acid gas. The author proves that, in that case, there is formed first a chloride of the acid radical, and that that chloride afterwards gives rise to the formation of the compound ether. The author describes at length a process whereby it is possible to obtain, by the action of hydrochloric acid gas upon benzoic acid, chloride of benzoyl.

Primitive Normal Butylic Alcohol.—Messrs. Lieben and Rossi.—This lengthy paper contains the results of experiments made by the authors to prove that a compound discovered and described by M. Wurtz as a butylic alcohol, in the year 1850, is only an isomer of the true and genuine butylic alcohol obtained in a peculiar manner, described at great length by the authors, and wherein an aldehyde plays an important part. We conclude these abstracts by simply quoting the titles of the following papers, which are either purely physical, or are not well suited for proper abstraction with due justice to their contents, and the labours bestowed thereupon by their authors:—

Compressibility of Liquids.—Messrs. Amaury and Descamps.

Measure for the Conductive Power for Electricity of such Fluids as are Generally Hitherto considered as Non-Conductors.—M. Said Effendi.

Alcoholic Fermentation Excited by the Microzymas of the Liver.—M. Béchamp.

Toluylen-Diamine.—M. G. Koch.—

Researches on Inuline and the Acetic Acid Derivatives therefrom.—Messrs. Ferrouillat and Savigny.

Deutsche Industrie Zeitung, May 24, 1869.

Detection of Arsenical Pigments.—M. C. Puscher states—That during the first five months of this year, no less than eight cases of accidental poisoning by these pigments have occurred at Nürenberg; he advises the use of liquid ammonia for the detection of these pigments, all of which, he says, are soluble therein, exhibiting a blue coloured solution, if copper is at the same time present; he further states that, on the evaporation of the ammonia, there remains a dirty greenish coloured precipitate of arsenite of oxide of copper; his advice is to paint some *white* paper with this solution in ammonia, which painting, when dry, if arsenic were present, will exhibit a dirty greenish colour, but if after drying a blue colour appears to have been imparted to the paper, the pigment is quite free from arsenic, and only consists of a compound of copper, of which latter metal there are several in use, as green and blue pigments, all soluble in ammonia, except such adulterations as do not essentially belong to the pigment itself.

The Journal of the Franklin Institute (No. 4), April, 1869.

We notice from this paper the following communications and papers:—

Spectrum Lines, a New Method of Illustrating them.—At a late meeting of the American Institute, Professor E. C. Pickering, of the Massachussetts Institute of Technology, employed the following method to illustrate his paper on spectrum analysis. A sheet of black lace, 1½ ft. broad, and 3 ft. high, was suspended as a screen, and upon it was thrown a continuous spectrum from a magnesium light, arranged in the manner first developed for electric light by Professor Cooke, of Cambridge, U.S., except that only one bisulphide of carbon prism was used. The spectrum covered the entire lace screen, the curvature of its lines being corrected by an opposite curvature of the opening through which the light passed. Upon this black lace were attached a number of strips of white paper, so arranged as to occupy the places of the bright lines in seven different spectra, such as those of sodium, potassium, rubidium, cæsium, &c. These being illuminated by the variegated light of the continuous and broad spectrum, received and reflected each colour corresponding to its position, and, therefore (their adjustment being accurate), that which actually belonged to the band which it represented. The light falling between these paper bands was, of course, not reflected, and the appearance, therefore, was in each case (as in an actual spectrum) that of bright-coloured lines on a dark ground. When, however, as in the case of potassium, the nebula of Orion, &c., a faint continuous spectrum is, in fact, combined with that of the bright lines, this, also, was represented by attaching, in the required places, bands of white lace, which reflected enough of the coloured light to produce a hazy spectrum, admirably imitating that of the substances or bodies in question.

Acid-Proof Cement.—R. F. Fairthorne.—It frequently happens that the chemist requires some means for protecting cork from the destructive action of vapours such as arise from boiling nitric acid; the author found the following plan to meet this requirement:—Finding it necessary to connect a glass tube with a wide-mouthed flask, and, in so doing, to use a cork, which was exposed to the action of the fumes from boiling nitric acid for several hours, the author found the best preservative to consist of a coating of silicate of soda and powdered glass. The cork, having been bored to suit the size of the tube, was soaked for two or three hours in a solution of silicate of soda, consisting of one part of commercial concentrated solution to three parts of water. The tube was next inserted, and, when dry, the cork was covered with a paste, made by mixing the concentrated solution of the silicate with powdered glass, in such proportions as to form a mass of about the same consistence as that of putty. This is spread on the under surface, and then washed with a solution of chloride of calcium. It soon hardens; so that it is advisable to make the connection with the flask whilst the paste is in a plastic state, and to allow it to become solid before applying heat to the vessel containing the acid. Corks protected in this manner were but slightly acted upon after remaining over the boiling nitric acid more than four hours, and over hot acid for ten. The cement, the preparation and use of which is herein described, is very useful for general use as a luting for chemical apparatus.

Hot-Cast Porcelain.—Charles P. Williams.—This is the trade name of a peculiar tough, milk-white, translucent glass, not unlike French porcelain in appearance, and extensively made at Philadelphia and Pittsburg, U.S. It is intermediate in character between the glasses produced by the addition of phosphate of lime to the ordinary glass materials, on the one hand, and the white enamels, such as are produced by oxide of tin on the other, having more of the milkiness than the former and less opacity than the latter. The raw materials consumed in its production are sand, oxide of zinc, and cryolite, which are melted together in the ordinary clay pots of the glass maker. The following is the composition of an average sample of this glass, taken when the "metal" was in its best working condition:—Silica, 63·84; alumina, 7·86; peroxide of iron, 1·50; protoxide of manganese, 1·12, oxide of zinc, 6·99; lime, 1·86; magnesia, 0·25; soda, 10·51; fluorine, 8·05, [less oxygen (corresponding to the fluorine), 3·39] = 98·59 for 100 parts. The above is the mean of five analyses. The method pursued in the above analyses consisted in fusing the compound with carbonate of soda, extracting with water, and, after precipitating the silica and alumina in the aqueous solution by means of carbonate of ammonia, separating the fluorine as fluoride of calcium mixed with carbonate of lime, by the addition of chloride of calcium. The mixed salts were afterwards treated with acetic acid, and the separated fluoride of calcium, dried, burned, and weighed. The remainder of the analysis was conducted as is usual in the analysis of silicates, the alumina and oxide of iron being precipitated as basic acetates, and separated, after weighing, by means of tartaric acid and sulphide of ammonium. Admitting the fluorine to exist in the glass in the condition of silico-fluoride of sodium (NaF,SiF_4), the following formula will express the composition of the compound:—

$$2[R_8O_{23}SiO_8 + 3(RO_3SiO_8)] + NaFSiF_2.$$

Zeitschrift für Chemie, von Beilstein, No. 9, 1869.

The original papers contained in this periodical are—

Monochlorocrotonic Acid and its Salts.—M. O. Froelich.—When two parts by bulk of perchloride of phosphorus act upon one part, by bulk, of ethyldiacetic acid, two new acids containing chlorine are formed; both are crystalline, and they are isomeric with each other; only one of these acids, the monochloroacetic acid,

$$C_4H_3ClO_8, (C = 12, O = 16),$$

has been further investigated; the pure acid is a solid substance, exhibiting crystalline structure, fusing at 59° C.; becoming solid again at 55°C.; boils at 194·8° C.; it is a rather volatile substance, prone even to sublime when kept in closed bottles at the ordinary temperature of the air. It is not very soluble in water; at 7° C. one part of the acid requires 79 parts of water for solution; readily soluble in ether and alcohol. It is a rather powerful acid, easily decomposing carbonates. The author has prepared a series of salts of this acid with alkaline, earthy, and metallic bases: the potassa salt, $C_4H_4ClO_3,K + H_2O$, is crystalline, like almost all of the salts this acid forms. Monochlorocrotonic acid-ethyl ether, $C_4H_4ClO_3(C_2H_5)$, is a colourless, oily fluid, possessing an aromatic odour and a cooling taste, boils at 161·4° C. Its specific gravity at 15° C. is 1·113. Slightly soluble in water, readily in alcohol and ether; does not affect the vegetable colours, as, for instance, litmus. The methyl-ether analogous with the preceding—

$$C_4H_4ClO_3(CH_3)$$

is an oily fluid boiling at 142°; its specific gravity at 15° is 1·143. Insoluble in water, less soluble in alcohol than the preceding.

Presence of Peroxide of Hydrogen in the Atmosphere.—M. H. Struve.—The author, writing from Tiflis, Central Russia, states that his observations and researches of the water of the river Kurr, after a heavy rain or snowstorm, led him to detect therein first, ozone, next peroxide of hydrogen, and afterwards nitrite of ammonia. In

order to detect peroxide of hydrogen in rain or snow-water, the author adds to 25 c.c. of water, 5 drops of a clear iodide of potassium and starch solution, and next a single drop of a solution of sulphate of protoxide of iron and ammonia. When only traces of HO_2 are present, a blue colouration soon ensues, but soon also disappears. The author has not made any quantitative researches, but he avers that, owing to the presence of HO_2 in the water obtained from snow and rain, at Tiflis at any rate, and in that portion of Europe, peroxide of hydrogen may be present.

On some Derivatives from Methylen.—M. Butlerow.—Chloride of methylen, CH_2Cl_2, was prepared from pure iodide of methylen, by passing a current of chlorine through it while placed in a distilling apparatus under water, and a long-continued purifying process; the chloride of methylen is a colourless, very mobile fluid, exhibiting a smell akin to that of chloroform, and like that endowed with a sweet, burning taste. Chloride of methylen is somewhat soluble in water; its specific gravity is at 0° C. 1·3604; it consists, in 100 parts, of—C, 14·12; H, 2·35; Cl, 83·53. Hexamethylenamin is the result of the action of oxymethylen and ammonia upon each other; this base yields with hydrochloric acid a crystalline compound, $C_6H_{13}N_4Cl$.

Bromated (Gebromtes) Toluidin.—When it is desired to prepare bromated aceto-toluidin, the latter substance is placed in a vessel and water is poured over it, and next bromine is added in small quantities at the time; the monobromated aceto-toluid, $C_7H_6BrN(C_2H_3O)H$, is a solid, crystalling in needle-shaped crystals, difficultly soluble in water, readily so in alcohol; fuses at 117·5° C.; bromated-toluidin is a colourless liquid, boiling at 220° C., insoluble in water; specific gravity 1·510 at 20° C. The nitrate of this last compound, $C_7H_6Br.NH_2.HNO_3$, is a beautifully crystalline substance, not readily soluble in water, fusible at 182° C., but at the same time becoming decomposed.

Action of Sulpho-Chloride upon the Bromide and the Iodide of Ethyl.—M. E. Wroblevsky.—SO_2HCl does not exert any action at all upon $C_4H_4Br_2$ until the heat of a water bath is applied; HBr and Br then escape. After dilution with water, neutralisation with $BaCO_3$, and a careful evaporation, the author obtained a salt, $(C_2H_4Br.SO_4)Ba_2$. SO_2HCl acts very energetically upon C_2H_4I, while, thereby, separation of HI and I takes place. When SO_3, anhydrous sulphuric acid, is made to act upon $C_2H_3Cl_3$, and the product was saturated with baryta, the barium salt was obtained of a very unstable chlorinated compound.

Series of Isomeric Derivatives from Toluol.—MM. Beilstein and Kuhlberg.—Paranitrotoluidin, $p.C_7H_6(NO_2)(NH_2)$, is prepared by the reduction of dinitrotoluol and hydrosulphide of ammonium; it exhibits a yellow-coloured crystalline mass, fuses at 77°, is soluble in hot, not so well in cold, water; the nitrate, hydrochlorate, and sulphate of this base are all crystalline substances. Nitrate of paradiazonitrotoluol, $p.C_7H_6(NO_2)N_2.NO_3$, is obtained by treating nitrate of paranitrotoluidin with nitrous acid. Of the long series of derivatives obtained, we only mention yet β nitrotoluol. $\beta C_7H_7(NO_2)$, is a liquid boiling at 222° C., having, at 25° C., a specific gravity of 1·163; is not acted upon by chromic acid.

Observations concerning the Essay of Frémy on Hydraulic Cement.—M. A. Schulatschenko.—The only matter of interest to our readers in this paper (which reviews all which has been stated and done from the year 1786, beginning with the celebrated Chaptal, up to the present day, as regards the hydraulic and other cements, especially in respect of the cause of the hardening under water as well as in air), is the analysis of a marl found on the borders of the river Wolchow, Russia, and applied to the manufacture of cement by careful burning. In 100 parts, this material contains—Carbonate of lime, 63·84; carbonate of magnesia, 5·78; peroxide of iron and alumina, 3·22; sulphate of lime, 0·32; water, 1·04; the remainder was insoluble in hydrochloric acid, and consisted of—Silica, 18·16; alumina, 2·02; peroxide of iron, 3·56; potassa and soda, 1·66; together, 99·60. This material yields, after burning, a product which, on being treated with water, becomes strongly heated, swells up and falls to powder, as does burnt limestone, but unlike it, the material alluded to hardens slowly under water; if, however, this marl happens to be more strongly burnt, exposed to more than a faint red heat, not visible in daytime, a product is obtained which does not, on coming into contact with water, act as just described, but which very rapidly sets and hardens under water. The author observes that we have to distinguish two kinds of cement such as contain lime in a free state, the Roman cements of M. Winkler, and the hardening of which has been fully explained by Fuchs, and such cements which do not contain lime in a free state, the Portland cements of M. Winkler, the hardening of which is as yet not well explained. According to M. Rivot and others, the cause of the hardening is due to the binding of water by the silicates formed during the burning, while, according to Winkler and others, the effect of water and the cause of hardening is due to the splitting up of silicates into more simple silicates. It is a fact, however, that the action of lime upon Puzzolanes is not sufficiently great solely to explain the hardening of cements.

No. 10, June 8, 1869.

We learn from this number that a very flourishing Chemical Society has, with the permission of the Imperial Government, been established and recognised as one of the scientific institutions of the Russian Empire; the transactions of this society are to be published in the Russian language. The only original paper in the above-named periodical is the record of several researches made at St. Petersburg—

Isomeric Phenolsulpho-Acids and the Action of Chloride of Benzoyl on the Potassa Salt of that Acid.—M. Solomanoff.—according to the author's researches, there exist three isomeric phenolsulpho acids, all of which are simultaneously formed when sulphuric acid acts on phenol. The author distinguishes these acids by α, β, and γ, or by prefixing to the two first para and meta; the author prepared these acid in rather large quantities; the potassa salts of these acids are distinguished from each other by the following particulars: the α salt, $C_6H_5KSO_4$, crystallises in six-sided foliated crystals, is the most difficultly soluble of the three salts in water, fuses at 240° C; the β salt crystallises in needle-shaped crystals, and is capable of taking up variable quantities of water of crystallisation, varying from 1·01 per cent to nearly 15 per cent; it fuses at between 235° and 240° C, yielding a yellowish liquid; the γ salt contains from 16·28 to 17·51 per cent of water of crystallisation, does not, on being heated, melt until it just reaches 240° C. When α phenolsulpho-potassium is heated with chloride of benzoyl, hydrochloric acid is given off and benzoyl-phenol-sulpho-potassium is obtained; this salt is soluble in water, and crystallises from its solutions therein in large needle-shaped crystals; the corresponding γ compound, after having been dried at 130° C, is composed according to the formula $C_6H_4(KSO_3)O(C_7H_5O)$; it is difficultly soluble in cold water, but readily in hot water; also soluble in warm alcohol.

Action of Chlorosulpho-Anhydride, $HClSO_3$, on Phenol and Phenolsulpho-Potassium.—MM. Engelhardt and Latschinoff.—The authors made some experiments in order to ascertain whether, when instead of sulphuric acid the compound SO_2HCl was made to act upon phenol, the result would be the formation of one acid only, or of three isomeric acids, as in the instance just previously alluded to; when to one equivalent of phenol, one equivalent of SO_2HCl is added, a very strong reaction takes place, the mixture becomes hot, hydrochloric acid is given off, a thickish red-coloured mass is obtained, from which, by gently heating, all hydrochloric acid was expelled; the mixture after having been formed into a potassium salt, this proved on analysis to be pure α or para phenolsulpho-potassium; the authors made experiments with divers proportions and quantities of SO_2HCl and phenol, and found as result chiefly the production of the acid of the salt just referred to.

Phenol Phosphosulpho-Acid.—M. Maikopar.—The author has studied the action of sulphuric anhydride upon phosphate of phenol, and also the action of phosphor oxychloride upon para phenolsulpho-potassium; the author describes at great length his researches: dry phenol phosphosulpho-barium, $(C_6H_4BaSO_3)_3PO_4$, gave in 100 parts—Baryta, 27·72; sulphuric acid, 29·84; and phosphorus, 4·03. When oxychloride of phosphorus was heated with dry para phenolsulpho-potassium a solid mass was obtained, on exhausting this with ether the latter left on evaporation an oil which was found to contain chlorine, phosphorus, and a substance belonging to the phenolsulpho-acid group; but the results of the analysis of this substance gave figures from which no definite formula could be deduced.

On Murrayin, a Newly-Discovered Glucoside.—Prof. Blas.—The author states that he received from Dr. de Vrij a quantity of murrayin, extracted by the latter gentleman from the *murraya exotica* during his sojourn in the East Indies; in pure state murrayin is a white coloured solid substance, exhibiting needle-shaped crystals, its taste is slightly bitter; it is difficultly soluble in cold water, and insoluble in ether, readily soluble in boiling water and in alcohol; these solutions are neutral to test paper. Murrayin fuses at 170° C.; is readily soluble in solutions of caustic and carbonated alkalies; these solutions exhibit a high degree of fluorescence, they appear yellow in direct light, greenish blue when the rays of sunlight are made to pass through the solutions; crystallised murrayin has the formula $C_{26}H_{44}O_{20} + H_2O$; when one part of murrayin is mixed with one part of strong sulphuric acid, and 25 parts of water, and this mixture heated in a sealed tube or in a flask, in an atmosphere of carbonic acid, the substance is split up. murrayetin and sugar being formed; this splitting up takes place according to the following formula:—

$$C_{26}H_{44}O_{20} + 2H_2O = \underbrace{C_{14}H_{14}O_{10}}_{\text{Murrayetin,}} + 2C_6H_{12}O_6.$$

Murrayetin is a solid substance, which readily crystallises; its concentrated solutions have a weak acid reaction; with perchloride of iron, it yields a beautiful blue colouration.

TO CORRESPONDENTS.

ERRATUM.—"G" sends the following corrections to the note "On the Employment of Constant Factors," in No. 498, p. 300:—Line 8, *for* 13 *read* 16; line 11, *for* 13 *read* 16; line 12, *for* 12 *read* K; line 13, *for* 39 *read* 39·2.

Biography of Dumas.—Dr. Muspratt informs us that his Biography of J. B. Dumas, M.D., was published in the *Lancet* in 1851, vol. I, p. 248.

F. Cant.—This correspondent wishes to know what public institutions there are for the study of chemistry in Nottingham. Perhaps some of our correspondents can give the desired information.

BOOKS RECEIVED.

Sound; A course of Eight Lectures delivered at the Royal Institution of Great Britain. By John Tyndall, LL.D., F.R.S. Second edition. London: Longmans, Green, and Co.

What is Matter? By An Inner Templar. London: Wyman and Sons.

The Retrospect of Medicine. Edited by W. Braithwaite, M.D., and James Braithwaite, M.D. Vol. lix. London: Simpkin, Marshall, and Co.

The Quarterly Journal of Science.

popular Science Review.

THE CHEMICAL NEWS.

Vol. XX. No. 503.

ON

HEAT TREATED AS A SCIENCE OF KINETICS.*

By G. F. RODWELL, F.C.S.

(Continued from p. 10).

II. (Abstract).

In this lecture, some of the effects of heat upon matter were discussed, commencing with expansion; and the experiments which illustrate this part of the subject were shown (such as the unequal of a compound bar, S'Gravesande's ball, and the various appliances by which liquids and gases can be shown to expand, as the alcohol and mercury thermometer, Galileo's air thermometer, Leslie's differential air thermometer, and so on). The intensity of the attractive force exerted by similar molecules acting through an insensible space (cohesion) was shown by the breaking of a bar of iron by the contraction of a metal bar during cooling.

The following definitions are taken for the most part from the lecture notes:—

"*Æstus est commotio . . . omnis commotio ferrorem gignit.*" Heat having been defined in the last lecture as a motion of the small particles, or molecules, of matter, it is obvious that the addition of this motion to a congeries of molecules must cause them to occupy a greater space (*expansion*); while the subtraction of this motion must cause them to occupy a less space than before (*contraction*).

In virtue of this, heat determines the form which matter assumes. In solids, the attraction of the molecules for each other (sometimes called *cohesion*, from *cohæreo*, to stick together), greatly predominates over the molecular motion, and, by limiting the range of movement, keeps them comparatively close together. In liquids, there is a greater amount of molecular motion; hence the range of movement of the molecules is extended; the cohesive force is lessened by the distance, and the molecules have a less restrained motion. In gases, there is a still greater amount of molecular motion: the molecules move at such a distance from each other that their individual attraction becomes a vanishing force; hence they are absolutely unrestrained in their motion. Thus, in the passage from solidity to gaseity, there is a progressive decrease of cohesive force, arising from a progressive augmentation of the space between the attracting molecules, and a progressive increase of molecular motion, arising from direct addition; while in the passage from gaseity to solidity, there is a progressive increase of cohesive force, arising from the diminution of the space between the attracting molecules, and a progressive decrease of molecular motion; arising from direct transference.

An increase of external pressure will obviously tend to approximate the molecules of matter; and hence, *à priori*, will, to some extent, produce the same result as a subtraction of molecular motion; while a decrease of external pressure will afford the molecules a greater range of movement, and will hence produce the same result as an addition of molecular motion. Thus certain gases are liquefied by increasing the pressure (for example, chlorine and sulphurous anhydride), and certain liquids are gasefied by the removal of the existing pressure (for example, ethers having low boiling points, and, *à priori*, the liquids of gases liquefied by pressure).

We do not know the nature of the motion which constitutes heat. According to an hypothesis, which is ably supported, the molecules of solids and liquids move circularly around a centre, while the molecules of gases move in right lines. Thus a solid becomes liquid, in the language of this hypothesis, when the amplitude of the oscillation of its molecules passes a certain limit; and a liquid becomes a gas when its molecules fly off at a tangent to the circles in which they previously moved. This hypothesis is eminently Cartesian in its tone and character. (Examples of the passage of circular into tangential motion may be frequently observed—notably in the water which is projected from a trundled mop, in the sparks which fly off from a Catherine wheel, in the mud projected from the periphery of a rapidly-moving carriage wheel, and in a stone hurled from a sling. This last example is frequently adduced by Descartes (see his *Principia Philosophiæ*, pars. 2, cap. 39, entitled, "Altera lex naturæ, quod omnis motus ex se ipso sit rectus, et ideo quæ circulariter moventur, tendere semper ut recedant a centro circuli quem describunt;" and again, pars. 3, cap. 57 and 58). As a lecture experiment, it may be shown by attaching a small wooden ball to a spring (a helix of brass wire answers the purpose well), and communicating circular motion by whirling it in a vertical plane, either by the hand, or by a whirling table. As the velocity of revolution increases, (analogous to the increased molecular motion induced by heating), the ball recedes from the centre of revolution (analogous to the act of expansion), until, at a certain maximum of rapidity, the ball may be released, or may be caused to break the spring, when it of course assumes a rectilinear motion (analogous to the passage of a liquid into the gaseous condition); or the helix of brass wire may be replaced by a piece of india-rubber tubing, to one end of which the ball may be fastened by a movable pin, worked by a string, which passes through the axis of the tube and is held by the hand. The revolution is commenced, and, when at its maximum, the string is pulled so as to dislodge the pin, and thus release the ball, which immediately changes its circular for tangential movement; or, again, rapid circular motion may be communicated to a very shallow bowl containing water, and the velocity augmented until the particles of water fly off tangentially.

Heat is usually measured by the expansion of a liquid or gas, it having been found that equal additions of molecular motion produce, (α) in the case of gases, equal alterations in bulk, irrespective of the nature of the gas; (β) in the case of liquids, nearly equal alterations in bulk in the same liquid, although different alterations in different liquids. (*Thermometry*, θερμος, heat; μετρον, a measure).

A *degree of heat* is an arbitrary quantity, and it may be defined as the amount of molecular motion which is competent to increase the bulk of a certain quantity of specified matter to a certain known extent. A *unit of heat* was defined in the last lecture.

The *co-efficient of expansion* of a substance is the increase in length, (*linear co-efficient*), or in bulk, (*cubical co-efficient*), produced by the assumption of a certain amount of molecular motion, by a substance whose length or bulk was known when it possessed a certain less amount of molecular motion, in both cases measured as described above. Thus, if the length of a brass rod at the freezing point of water (32° F.) be taken as 1·000000, its length at the temperature of boiling water (212° F.) will be found to be 1·001867, and the linear co-efficient of expansion of brass for 212° − 32° F. = 180° F. is hence 0·001867, and for 1° F. = $\frac{0{\cdot}001867}{180}$ = 0·00001038.

Evaporation (*evaporo*, to disperse in vapour), is the conversion of a liquid into gas at its exposed surface. The molecules at the surface, unlike those in the mass of the liquid, are influenced and restrained by the proximity of other molecules, *in one direction only*: hence, in the language of the hypothesis mentioned above, they more readily assume the rectilinear motion appertaining to the molecules of a gas.

Ebullition, or boiling, (*ebullio*, to boil or bubble up), is the conversion of a liquid into gas by the assump

* A course of four lectures delivered at the London Institution.

rectilinear motion by the molecules in the interior of the liquid mass. The liquid continues to receive molecular motion until the cohesion of its molecules (plus or minus any of the extraneous actions mentioned below) is overcome; the molecules thus freed from restraint, part company with the liquid in the form of bubbles of gas. The temperature at which this takes place, subject to the conditions which at that time prevail, is called the *boiling point* of the liquid under those conditions.

The boiling point of a liquid is influenced by the following extraneous causes:—(α), external pressure, which, by limiting the motion of the molecules, and thus assisting cohesion, raises the boiling point; (β), the substance of the containing vessel, between which and the liquid molecules a certain attraction, differing for different substances, exist, which consequently assists cohesion, and raises the boiling point; (γ), dissolved substances, which in the case of dissolved solids tend to raise the boiling point, and in the case of dissolved air, to lower it. Thus water boils—(α) at a lower temperature on the summit of a mountain than at its base; (β) at a higher temperature in a glass than in a metal vessel; (γ) at a higher temperature when it contains salt in solution, as in sea water, than when it is free from dissolved solids, as in rain water; and at a far higher temperature when it is freed from dissolved air than when it contains air in solution.

Evaporation in the spheroidal condition is the surface evaporation of a liquid spheroid, floating upon a layer of its own gas, which separates it from direct contact with a surface possessing a higher (usually, but not necessarily, a much higher) temperature.

The spheroid has been proved to be out of contact with the hot surface by various means; thus the light of a flame can be seen through the space intervening between the spheroid and the hot surface, and nitric acid in the spheroidal condition upon a hot plate of copper does not attack it; neither does dilute sulphuric acid act upon zinc under the same conditions. We have analogous actions in the reverse experiment, in which a hot metal is caused to float upon a liquid surface, buoyed up by the layer of gas beneath. Thus, if a light silver ball be heated to whiteness, it will readily float upon the surface of water; and when iron is burned in oxygen, the globules of molten oxide will frequently float for a second or two upon the surface of the water beneath, or sometimes they will fall through a layer of one or two inches of water, and yet be sufficiently hot when they reach the bottom to fuse themselves into the glass or earthenware tray. Again, the freezing of water and mercury in red-hot vessels is due to the same action: liquid sulphurous acid evaporates comparatively slowly upon a white-hot surface, and when a mixture of solid carbonic acid and ether is poured into a red-hot platinum crucible, it immediately assumes the spheroidal condition, evaporates comparatively slowly, and will readily freeze mercury.

ANALYSIS OF THE WATER OF THE "ROYAL SULPHUR SPRING," HARROGATE.

By SHERIDAN MUSPRATT, M.D. (Hon.), F.R.S.Ed., M.R.I.A., &c.

THE water of this new spring has recently been introduced into the Royal Pump Room at Harrogate Wells, and, as it may prove an efficient *intermediate* one (*i.e.*, not so *strong* as the "Old Sulphur Well," *vide* my analyses, CHEMICAL NEWS, vol. viii., p. 155, and *stronger* than the "Magnesia Water," vol. viii., p. 195), I forward the results for publication in your valuable journal. Its characteristics, on reaching me (it was in a large stone jar, well sealed), were the annexed:—

An opaque appearance, owing to a separation of sulphur; a strong smell (this it does not evolve when drawn from the pump) of sulphide of hydrogen, which, collaterally with the milky shade of the liquid, indicated oxidation and decomposition of the sodic sulphide (NaS). On immediately filtering the water, the filtrate was perfectly clear and bright. During the analysis, &c., I found that, on boiling the water by direct heat, and likewise by the agency of steam, 1·986 grains per gallon of the sulphur were eliminated as gas (sulphide of hydrogen), the remaining portion withstanding the effects of both kinds of caloric. The water was alkaline, due to the earthy carbonates. The sulphur calculated as gas (sulphide of hydrogen) constituted 11·80 cubic inches per gallon. By prolonged exposure to atmospheric influences, the *whole* of the sulphur in the water deposited. It gave no organic matter, and only mere indications of ammonia, &c. The occurrence of the salts of barium, strontium, lithium in all the spas of Harrogate is very remarkable, for these compounds did not, and could not, exist in them twelve years ago, when my distinguished collaborateur, Dr. Hofmann, investigated them. Sulphates have disappeared from all of them. I do not consider that the presence of the chlorides of barium and strontium in any way enhances their medicinal properties; for, as soon as the water is imbibed, the chlorides become sulphates.

There can be no question, I think, that the additional ingredients are derived from the strata in the vicinity of Pately Bridge, nine miles west of Harrogate. All the strong spas contain barium and strontium; the Dr. Muspratt Chalybeate "chloride of iron" (FeCl) also. A recent analysis of it gives 16 grains of this latter salt in the gallon; so the amount is just the same as it was when I discovered its presence in 1865. The efficacy of this ferruginous compound in a potable water is now beyond a doubt; it is more easily assimilated than any other ferrous salt: Dr. Myrtle remarks—"I could fill volumes with cases benefitted or cured by its use."

College of Chemistry, Liverpool,
July 1st, 1869.

ON THE

EXAMINATION OF WATER FOR ORGANIC MATTER.*

By R. ANGUS SMITH, Ph.D., F.R.S., &c.

(Continued from vol. xix., p. 306.)

Use of Permanganate of Potash, or Chameleon.

IT must be remembered that the amount of organic matter obtained in the above way by weighing and burning may be equal to several grains in a gallon, and yet be quite innocent; for example, it may be a little peaty matter. One method of trying the quality is given above; another, of a very convenient kind, is by the use of permanganate of potash, or mineral chameleon. It will here be called chameleon, as the former term is very long. It is very highly coloured, and its decomposition is known by the disappearance of the colour.

Chameleon is decomposed by putrid organic matter, and by several unwholesome gases, rapidly or instantaneously. It is decomposed by fresh organic matter, and especially organised matter, less rapidly. The putrid portion may be estimated readily; the latter is more uncertain.

In using this test, it is well to take not less than 5000 grains of the water, or, still better, 1000 grammes, *i.e.*, one litre; but if a small specimen only can be obtained, then as little as 1000 grains may be used; but it is well always to give the figures for 1000 for uniformity, or (by multiplying by 70) to change them into the amount per gallon; one million, however, is still better, and I propose to use

* From vol. iv., 3rd series, of the *Memoirs of the Literary and Philosophical Society of Manchester*. (Communicated, with emendations and alterations, by the author).

it always for air and water. Grains or grammes may be used indifferently, the solution being made to contain simply so much in 1,000,000.

A convenient plan is to use 2 grains of the pure crystallised chameleon to 1000 of water. This, of course, is the same as 2 grammes to a litre of water.

The chameleon is poured conveniently from a Mohr's burette, or, better still, when the water is very pure, from a dropping-tube in which 1 c.c. is 6 to 8 inches long. Add a drop of the chameleon, and wait till the colour disappears; add another, and so on, till the colour remains permanent. The organic matter which decomposes the chameleon in a minute or two must be noted carefully; but generally there is a greater quantity which decomposes very slowly; the result obtained from the latter is, I believe, of less value. By decomposing in a minute or two, it is meant that when a few drops are added, producing a slight colour, this undergoes a change in a minute or two. But generally, considerable permanency is obtained in ten or fifteen minutes; then the slow decomposition begins of quite another quality of organic matter, requiring hours, or even days. This matter must be estimated either by the weighing process described, or by the further action of the chameleon, to be described. The amount decomposed instantly is a true measure of the putridity, it is believed. If there is very much organic matter, it is often very difficult to know when to stop, as the brown masks the red colour. But this must not bring discouragement, as experience will teach exactness; and, if it does not allow exactness, it then will be no great loss in such cases in a sanitary point of view, as in them there is decidedly too much organic matter, and the water may be condemned. From the same point of view, it is of less consequence whether the amount be a minute quantity more or less. It is well to make broad lines of distinction, and to condemn freely when there is rational hope of obtaining a purer water.

The amount of available oxygen in one of the solutions of chameleon described is 0·0005, which may be either grammes or grains, or almost exactly 1 of oxygen in 2000 of the solution. If we wish to know the amount of oxygen used, we simply divide the amount of chameleon by 2000. It is probable that the use of the oxygen column is the only exact method of recording the results; and it is probable that the amount of oxygen required is the only exact measure of the impurity of the substances. We obtain in this number the amount of oxygen which is required for purification.

Whilst looking over this plan in manuscript, I received Dr. Miller's paper, proposing also to use oxygen; he prefers a solution of chameleon containing 3·95 grains, equal to 1 grain of available oxygen to 10,000 of water, or 1 c.c. = 0·001 gramme, or, say, 1 milligramme of oxygen. This is a very convenient method; but it has been thought proper to keep the tables as given for various reasons, chiefly arising from this—that it has not been found so convenient to keep or to titre a very weak solution. In some cases, a very strong solution is required; we can easily dilute it, but we cannot concentrate it readily. After estimating its strength, we dilute it (if we require a weak solution) to any amount we think proper; and as the strength changes, the amount of water to be added will also change. If the amount of oxygen is given as the result of the analysis instead of the amount of chameleon solution, the strength of the latter does not require to be kept uniform. The analyst requires only to know its strength at the time of using it. For very bad water, the strong solution may be used; and, when greater delicacy is wanted, it may be diluted. The weak solution here used is made by adding nine of water to one of the strong solution.

To make the chameleon solution, very pure water must be employed, and very pure crystals, as well as very pure vessels; it is better kept in considerable quantities, such as a quart or two. It must be tried occasionally, say every month, in a cool climate: calculat[illegible] as allowance for any change which it may undergo. If calculation is not agreeable, a less quantity of solution may be made at a time, and that which is over may be thrown away, a fresh amount being made to the normal strength whenever the original weakens; or a certain amount of the crystals may be weighed and added to the solution; but this has been found less convenient.

The estimation of the value of the chameleon is sometimes made with a solution of chloride of iron, sometimes oxalic acid. For ready reference, a table is made showing the amount of a solution of iron which corresponds to a certain amount of chameleon. The sulphate of ammonia and iron has proved to be very valuable. The writer has not found oxalic acid equally sharp and quick; but eminent chemists use it—Mohr and Miller, for example.

Values of the Strong Solution.

Permanganate of Potash or Chameleon 2 grammes in 1000 c.c.	Oxygen.	Ferrum.	$FeO,SO_3 + NH_4O,SO_3 + 6Aq.$	KO,Mn_2O_7.
c.c.	gr.	gr.	gr.	gr.
1	0·000500	0·0035	0·0247	0·002
2	0·001000	0·0070	0·0494	0·004
3	0·001500	0·0106	0·0742	0·006
4	0·002000	0·0141	0·0989	0·008
5	0·002500	0·0176	0·1237	0·010
6	0·003000	0·0212	0·1484	0·012
7	0·003500	0·0247	0·1732	0·014
8	0·004000	0·0282	0·1979	0·016
9	0·004503	0·0318	0·2227	0·018
10	0·005000	0·03535	0·2474	0·020
100	0·050600	0·3535	2·4747	0·200
1000	0·506300	3·5353	24·7470	2·000

The numbers in the above table run in the following proportions nearly:—

Chameleon Solution.	Oxygen.	Iron.	Sulphate of Iron and Ammonia.	KO,Mn_2O_7 Crystals.
2000	1	7	49	4

It is convenient to use six figures of decimals, as they may also be read as whole numbers, meaning so much in a million.

Values of the Weak Solution.

Permanganate of Potash or Chameleon Solution. 0·2 gramme in 1000 c.c.	Oxygen.	Ferrum.	$FeO,SO_3 + NH_4O,SO_3 + 6Aq.$	KO,Mn_2O_7.
c.c.	gr.	gr.	gr.	gr.
1	0·000050	0·00035	0·00247	0·0002
2	0·000100	0·00070	0·00494	0·0004
3	0·000150	0·00106	0·00742	0·0006
4	0·000200	0·00141	0·00989	0·0008
5	0·000250	0·00176	0·01237	0·0010
6	0·000300	0·00212	0·01484	0·0012
7	0·000350	0·00247	0·01732	0·0014
8	0·000400	0·00282	0·01979	0·0016
9	0·000450	0·00318	0·02227	0·0018
10	0·000500	0·003535	0·02474	0·0020
100	0·005060	0·03535	0·24747	0·0020
1000	0·050630	0·35353	2·47470	0·2000

In the oxygen column, 6 and 3 may be left out.

The first and under might be called the first quality of water; from 0·1 to 0·2, the second; 1 would be the tenth.

When it is considered better to acidify the water before adding the permanganate, this is done by adding 3 drops or water-grain measures of sulphuric acid to 1000 grains; some water will demand more; the object is to attain acidity equal to about 3 drops of sulphuric acid in 1000 grains of distilled water. I find Dr. Miller says 50 grains of diluted sulphuric acid (1 of acid to 3 of water) added to 8 ounces of water. Acid enables the oxygen to act on more matter, and more rapidly. Alkalies prevent the action, although they may prepare some of the matter to be more readily oxidised: when the colour has been diffi-

cult to see, the chameleon may have been used with alkali instead of acid, in which case a green colour is obtained, serving usefully as a corroboration.

As an illustration of the mode of examining water so as to obtain the first and the second conditions, if we may so call them, of organic matter, I will quote here a short paper, read to the Philosophical Society of Glasgow, on the water of the river Clyde. I think I there gave the proper use of the permanganate of potash.* There is a very sharp separation between those substances that decompose the permanganate at once and without acid and those which do so on the addition of acid, and after a short time. So decided is this, that I consider them as indicating two different conditions of organic matter.

"I thought it would be interesting to test the Clyde in this way, and for that purpose obtained specimens at various points from near Bothwell to the sea, afterwards continuing till the vessel came near Liverpool.

"The column to observe is number 1 of annexed table of either series. This gives the amount of oxygen consumed instantly, and corresponds, as I believe, to the amount of decomposed matter which has left in solution putrid gases, whatever these gases may be. We may suppose them to be sulphuretted hydrogen in minute quantities, or compounds of sulphur, or organic substances only, or all mixed. In the part of the Clyde near Glasgow, all these compounds will probably be found; as we go near the Firth, the sulphur will be fully oxidised, and the organic compounds only will be the active agents in taking up the oxygen, as they oxidise more slowly.

"The amount of oxygen is calculated from the amount of permanganate employed. The method is an extension of the original idea given out by the late Forchhammer many years ago; the amount of water used was 100 c.c., or 1544 grains. The permanganate required to give perfectly pure water perceptible colour was in every case subtracted from the number obtained.

"The examination of the Clyde is not perfect, but there is much to be seen that is interesting. Specimens ought to have been taken higher than any town on the river.

"The first was taken about 6¼ miles above the quay at Glasgow. We there find the oxygen required for the water to be 0·000045 per cent by weight, or equal to 3·15 grains per 100 gallons. When we come to the Broomielaw, at Glasgow, we find the amount of oxygen demanded had risen to 0·00022 per cent by weight, or 15·40 grains per 100 gallons.

"We then see it steadily diminishing; and when we arrive at Port Glasgow, 20 miles down, it has become equal to that at 6¼ miles above Glasgow. If we had taken the north side, below Dumbarton, instead of the south, on which the vessels sail, the difference would have been greater.

"Leaving Greenock, and turning the point, we have a rapid change; and when off the west of Gourock Bay, at the distance kept by the Liverpool vessels, the amount of oxygen demanded fell to 1·05. Off Wemyss Bay, the fall is remarkably low; but it is not always so, as it depends on tide and wind. The current seems to run down the centre, whilst the ocean water comes up the coast. The winds and floods may modify this.

"We have to observe a complete change about Gourock or the Cloch, if we keep to the south and east side; but, if we keep to the north, the greatest change is perceptible not far off Helensburgh.

"This wide space of water reduces the amount of oxygen required to 0·00001 per cent by weight, or 0·7 grain per 100 gallons.

"We are now led to ask if the purest state of the water is attained here. We may go further towards the open sea, and find that the amount required falls to 0·000005 per cent by weight, or 0·35 grain per 100 gallons. This is at Arran, where the sea is more extensive, and oxidation, even of the peaty matter from the hills, is nearly completed. We observe this to continue till the entrance of the North Atlantic is past; and, as we come south, to a narrower channel, the amount of oxidisable matter increases, and keeps up steadily till we arrive at Liverpool. No specimen was taken nearer than 17 miles from Liverpool. The point 0·00001 per cent oxygen by weight, or 0·7 grain per 100 gallons, is an important one to examine. We find that at Dunoon, Innellan, and Holy Loch, this amount may be called permanent. We may ask, Why does it not fall lower? and is it true that the sewage of Glasgow affects the Firth until we arrive at Lamlash, and obtain the number 0·000005 per cent oxygen by weight, or 0·35 grain per 100 gallons?

"We observe that the amount of purification is remarkably rapid whenever the Clyde widens, as at Greenock to Gourock; so that, even near Helensburgh, the number has fallen to 0·0000125 per cent oxygen by weight, or 0·875 grain per 100 gallons. This change, from 0·000045 or 3·15 grains per gallon has been effected in the space of about 2 or 3 miles. Is it possible, then, that the slight further change required demands all the wide distance between Gourock and Arran? I think not. The reason we do not find the number for oxygen falling below 0·00001 per cent by weight, or 0·7 grain per 100 gallons, at Holy Loch, Strone, Dunoon, and Cove, may be seen by examining the Lochs. We there find that they themselves send in water with the oxygen number 0·00001 per cent by weight, or 0·7 grain per 100 gallons.

"At this point we must remember that the oxygen may not all be required for putrid matter, and that the streams contain some peaty matter which may also instantly require oxygen. At any rate, we know this, that, for whatever they do require it, it can be for the destruction of no very unwholesome matter in the water, as the highland streams must be considered free from such taints. There is a little of the soil of cattle when the weather is wet, but perhaps none when the weather is so dry that the water must pass through the earth before reaching the bed of the stream.

"We cannot, then, expect the sea-water to demand less oxygen than the streams and lochs that affect it here. In other words, we discover the influence of the land on the drainage from the hills, even when all trace of the influence of Glasgow has gone. This is, I believe, the reason that, according to circumstances, such as currents and weather, we observe the water of the Firth sometimes as pure as the deep sea, and at other times less so. At Wemyss Bay, for example, the table does not show this very well. This will happen at other parts of the coast when the streams enter purer than the usual sea-water there, as, for example, at Dunoon and Innellan, where the water flows from streams equal, when not in flood, to the deep Firth water. We see the influence of the coast, also, as we go on towards Liverpool, and between the Isle of Man and Lancashire.

"I considered that 0·00001 per cent oxygen by weight, or 0·7 grain per 100 gallons, marked the limits of the Glasgow sewage. If the sewage were not all expended, the amount would be greater, because the lochs and their streams do not show a higher number. Whenever the water of the Firth falls down to that of the streams, we are, as I suppose, receiving the air at least as pure as the air above the streams on the hills, and may be contented.

"Some people will perhaps demand more than this number. I have not made examinations far enough towards the ocean to enable me to speak of it; but it seems to me that the numbers 0·00001 per cent by weight, or 0·7 grain per 100 gallons, of the streams, and 0·00005 or 0·35 grain per 100 gallons, mark two very important points. The first characterises air which is certainly most wholesome and agreeable; the second is that ocean air which some persons require, but which to others is

* We never understood the author of this paper to claim having first used permanganate of potash for water. He readily acknowledges being later than Dr. Miller and Dr. Woods, and still later than Mr. Condy, who seems first to have carried out Forchhammer's idea. He simply wishes to show his mode of analysis and the results, leaving the question of merit entirely aside.—*Ed.* C. N.

said to be too strong. On the meaning of this expression "too strong," I will not attempt to speak; but it is very much used by a great public, and it must have a wide foundation. It is apparently certain that to some it is important not to have the extremely strong or perhaps purest air.

"These observations seem most curiously to coincide with general observation. The current of the Clyde keeps to the south; and we see that the water changes less rapidly there. At the north the direct current is not much observed, and the influence of the lochs or fiords is seen. The water from them presses against the Clyde current, and aids in keeping it to the south-east. This has influenced the building of the numerous residences on the Argyle side, lining all the coast. The population has not found it needful to make a chemical analysis, but has seen where the purest water was with the unaided eye. A mode of observation, apparently quite as good as chemical analysis, is the examination of the rocks on the coast, the dark and dirty aspects of these in impure water being very striking.

"I am not, however, inclined to look on my work here as useless, although common observation has done its part so well. I believe it to be of great importance to us to be able to apply tests so as to prove the truth of popular belief, which is formed by long and tedious processes. With these little chemical experiments we may do the work in an hour, which the instincts and expensive experience of whole generations were required to perform.

"I believe that in these results we have a method of examining the coasts which will be valuable to us as a sanitary police. It can be applied wherever there are sheets of water.

"I will not say that these numbers represent the relative wholesomeness of places on the land and on the sea; but I think it probable that they may fairly be used as comparisons of places on the sea only. When the land is in question, there are many sources of emanations to be considered.

"To be complete, the examination ought to be continued for several years. Last year was not an average one; there was much rain. (This regarding the Clyde and the sea was read in Dec. 1866.)

"There are floods in the Clyde which bear down so much water that the brown peaty matter is readily seen below Dunoon; but on these occasions there is no fear of putrid matter, as the water carried down is so abundant. At the same time there will be a certain degree of purity less at the sea-entrance, corresponding to the greater degree of purity caused by the flood at Glasgow. By this it is not meant that the water as low as Cloch or Dunoon is affected by more than an infinitesimally small amount of the sewage matter which is washed past Glasgow in floods, whilst at other times the effect has ceased, as before said, at least on the north, below Helensburgh. There is, however, a little muddiness observable for many miles, and this will be found even in places where the oxidation of all the readily transported matter has taken place.

"Even where total oxidation has occurred, a little muddy matter remains. It consists chiefly of earthy bodies, which may float until they obtain a suitable place for deposit.

"It would be interesting to find the time needful to perform this change on the organic matter of Glasgow. We see that the great bulk of the purification is performed in the fresh water. At Dumbarton it must be rare indeed that anything can be known to exist in the water from its smell. When the Clyde passes into the estuary, which may be said to begin at the Rock of Dumbarton, the change is effected by spreading the water over many square miles, and preparing it effectually for those who enter the sea- and Loch-regions below Helensburgh. Below this point it is not a river on which we are, but an arm of the sea, protected on all sides from oceanic waves.

"The water bears the qualities of coast-water in proportion to its excessive length of coast. This quality must exist more or less on all coasts which have fresh springs running into them. In cases where the rivers are large or numerous, the evil of the meeting of fresh and salt water is well known. On the Firth of Clyde no large bodies of fresh water are found after we leave the mouth of the river portion of the Clyde; and, as observed, these streams are remarkably pure, or, if coloured, it is only by peat-water. The absence of great rivers is therefore an advantage of an important kind to this coast.

"I was extremely glad to be able to speak thus favourably of the districts which are so agreeable to me; but I am certainly desirous of speaking still more favourably of some which are too much affected by Glasgow. They may be constantly deteriorating. This is a very serious matter, not merely for owners of property on the Firth, but for all the inhabitants of Glasgow, who are favoured more than those of any other large city in the kingdom by a ready access to this wonderful sanatorium.

In making these remarks, I take for granted that the air above the water will be pure in inverse proportion to the amount of volatile oxidisable matter.

"We must not, however, forget that, if the river is rendered impure, the town is proportionately purified. And we must also remember that the work done in the water is enormous. If the refuse matter were allowed to evaporate into the air, and so collect its oxygen, the act of purification would go on in the air we breathe; but now the water draws in oxygen, and, as soon as it is consumed, it draws in more. Even the air over the river is, at a distance of a few miles down, purer than the air of many towns; and when the spaces widen, the case is stronger still.

"I have sometimes inquired if we obtained in fish an equivalent of the manure sent out, and if it is not easier to gather the crop in boats than to put the manure laboriously on land. I find, however, that the loss by putrefaction, oxidation, and evaporation is so rapid that there was no hope of it being used profitably. In one current examined, a very deep one, and much stronger in sewer matter than the Clyde ever is, the whole nitrogen had disappeared in three days, the greater part in much less.

"Whilst the chief object of my paper is to show a new mode of examining climate as well as streams, I am glad to be able to say that Glasgow has failed to destroy the purity of the Firth beyond the points indicated, and that we may still rejoice in our summer dwellings. It is, however, not to be forgotten that the effects are found too far away, and that twenty-two miles of mischief is more than abundance. It is to be hoped that the cautious policy of the City in waiting for the best method to be adopted for using its refuse will enable it to carry out that future work, whatever it may be, with the greatest success.

"I have referred only to the 1st column: it indicates the amount of permanganate decomposed instantly; this represents the gases of decomposition, such as most readily pass into the atmosphere.

"It will not be supposed that this is the only offensive matter.

"The 2nd column represents the amount when acid is used to assist the oxidation. I suppose this to represent the amount easily decomposed.

"The 3rd column of the original paper, left out here, represents the amount of oxygen used by the organic matter in twenty-four hours. I do not at present see its use. I do not think this at all a fair mode of representing the impurity of water, unless we are sure that the quality does not change. We see this by the numbers above, and at Glasgow Bridge. The purer water has, by this mode of representing it, the appearance of being equal to the worst. The only column that gives the continuous increase and decrease exactly as the senses find the case to be is the column No. 1.

	Time.	Oxygen per 100 gallons required to oxidise		Oxygen by weight required to oxidise 1,000,000	
		I.	II.	I.	II.
		The decomposed organic matter.	The easily decomposable organic matter.	The decomposed organic matter.	The easily decomposable organic matter.
	Aug. 15, '66.				
6¼ miles above Glasgow	3.30 p.m.	3·15	11·55	45·0	165·0
5½ miles above Glasgow	3.15 ,,	4·55	9·45	65·0	135·0
5 miles above Glasgow, Cambuslang	3 ,,	5·95	11·20	85·0	160·0
Broomielaw	1.30 ,,	15·40	22·05	220·0	315·0
Mouth of Kelvin	1.20 ,,	11·55	18·20	165·0	260·0
100 yds. below Renfrew	1 ,,	10·85	25·55	155·0	365·0
100 yds. above Bowling	12.45 ,,	4·55	8·05	65·0	115·0
At Dumbarton	12.30 ,,	4·55	6·65	65·0	95·0
Between Greenock and Port Glasgow	12.10 a.m.	3·15	4.20	45·0	60·0
	July 25, '66.				
Gourock	12.55 p.m.	1·05	1·75	15·0	25·0
Cloch	12.45 ,,	1·05	1·57	15·0	22·5
Inverkip	12.30 ,,	0·70	1·40	10·0	20·0
Wemyss Bay	12.15 ,,	0·35	0·87	5·0	125·0
Opp. Toward	12 noon.	0·70	1·05	10·0	15·0
Between Toward and Cumbrae	11.30 a.m.	0·70	1·05	10.0	15·0
Opp. Cumbrae Lighth	11 ,,	0·70	0·87	10·0	12·5
Opp. Lamlash	10.15 ,,	0·35	0·70	5·0	10·0
	July 25, '66.				
188.	10 a.m.	0·35	0·87	5·0	12·5
176. Ailsa Craig	9 ,,	0·35	0·73	5·0	10·0
160. From Liverpool ..	8 ,,	0·35	0·87	7·5	12·5
131. ,, ,, ..	6 ,,	0·52	0·87	7·5	12·5
103. ,, ,, ..	4 ,,	0·52	0·87	10·0	12·5
74. N. of Isle of Man	2 ,,	0·70	1·05	12·5	15·0
	July 24, '66.				
46. From Liverpool ..	12 night.	0·87	1·22	12·5	17·5
32. ,, ,, ..	11 p.m.	0·87	1·40	12·5	20·0
17. ,, ,, ..	10 ,,	1·05	1·75	15·0	25·0
	Aug. 13, '66.				
Off Greenock	5.10 p.m.	1·40	1·57	20·0	22·5
	Aug. 15, '66.				
Off Helensburgh	6.35 p.m.	0·875	1·22	12·5	17·5
	Aug. 13, '66.				
Off Gourock	5 p.m.	1·22	1·57	17·5	22·5
	Aug. 13, '66.				
Between Kirn and Gourock	6 p.m.	1·22	1·40	17·5	20·0
	July 30, '66.				
Arrowchar (Loch Long)	1.30 p.m.	0·70	1·05	10·0	15·0
	Aug. 15, '66.				
Off Mouth of Loch Long	6.55 p.m.	0·875	1·40	12·5	20·0
	Aug. 17, '66.				
Head of Loch Goil ..	1.5 p.m.	0·875	1·05	12·5	15·0
Entrance of Loch Goil	4.30 ,,	1·05	1·22	15·0	17·5
	Aug. 1, '66.				
Head of Holy Loch ..	2.45 p.m.	0·70	1·57	10·0	22·5
Middle of Holy Loch ..	2.30 ,,	0·52	1·05	7·5	15·0
	July 31, '66.				
Dunoon (several 100 yds. from shore	1 p.m.	0·70	1·22	10·0	17·5
Dunoon (about 800 yds. from shore)	1.15 ,,	0·70	1·22	10·0	17·5
	Aug. 16, '66.				
Off Dunoon	1 p.m.	0·70	0·875	10·0	12·5
	Aug. 20, '66.				
Stream at West Bay, Dunoon	1 p.m.	0·52	0·70	7·5	10·0
Stream between Innellan and Dunoon ..	12 noon.	0·35	0·52	5·0	7·5
	Aug. 16, '66.				
Between Innellan and Dunoon	1.8 p.m.	0·875	1·05	12·5	15·0
Off Innellan	1.15 ,,	0·70	0·875	10·0	12·5
	Aug. 9, '66.				
Off Wemyss Bay (high tide)	12 noon.	1·05	1·22	15·0	17·5
Off Wemyss Bay (low tide)	4·30 p.m.	·875	01·22	12·5	17·5

"It is not, however, meant that the gases of decomposition are the only evils to be apprehended from impure water; but, so far as I know, they are those that affect the air principally (from this source). The most dangerous bodies are probably in the water itself, and it is possible that they may not be affected by the process of column 1.

"I am not inclined to draw any important conclusion from the total organic matter without inquiring into its character. At present, I believe, we are quite safe in attending to the conclusions here given in column 1, with such precautions as I have elsewhere indicated—when, for example, nitrites, sulphites, &c., are present. By and by we shall learn the true mode of dealing with the other columns."

(To be continued.)

NOTICES OF BOOKS.

Sound: A Course of Eight Lectures delivered at the Royal Institution of Great Britain. By John Tyndall, F.R.S. Second Edition. London: Longmans, Green, and Co., 1869.

Dr. Tyndall has proposed to himself to publish a series of works on Natural Philosophy, suited not only to the requirements of the students, but, as far as is practicable, to the popular ear. They are to have as their bases, the lectures which he is in the habit of giving, year by year, at the Royal Institution, and already two such handbooks have appeared—the well-known treatise "On Heat Considered as a Mode of Motion," and the treatise "On Sound," the second edition of which we have before us. The value of these works is too well known to the scientific to need any mention here. They form the most complete separate works on the several subjects of which they treat to be found in this language, and Dr. Tyndall is careful to introduce the most recent researches of continental philosophers, many of which are not readily accessible to the English public.

In comparing our scientific works with those of France and Germany, there are, however, several most notable differences; differences which rest with the publisher rather than the author, and until these be overcome we cannot have any great diffusion of standard scientific works in this country. We allude chiefly to the great expense of our works on science, and the above are no exception to the rule. Let any of our readers look at the volumes of the admirable *Bibliothèque des Merveilles* at 2 francs the volume, and ask himself what would be their price in this country—certainly seven shillings and sixpence. They are by eminent men, are well printed, and well illustrated, and such a series would be a great boon to this country. As to woodcuts, they, for the most part, excel those of our best works on science, into which we rarely introduce copper or steel-plates, and coloured engravings less rarely still.

The second edition of Tyndall "On Sound" differs but slightly from the first; the main difference is the addition of an appendix of 9 pages, containing an account of the recent researches of M. Regnault on the propagation of sound, written by himself. Many of our readers have heard Dr. Tyndall's lectures on sound, and will remember how well they were illustrated, specially as regards the production of Lissajous' figures, drawings of many of which are given.

The first lecture treats of the production and propagation of sonorous waves through various media. The second distinguishes between noise and music, musical pitch is defined, and a good account of the admirable "double syren" of Helmholtz (from his "*Die Lehre von den Tonempfindungen*,") is given. In the third lecture is discussed the vibration of strings, the general nature of progressive and stationary waves, and the optical examination of the vibrations of a piano wire. Lecture 4.—The vibrations of rods, square plates, discs, and bells. Lecture 5.—The vibrations of columns of air in organ pipes, the human voice, and reed-pipes. Lecture 6.— Sounding flames which have of late engaged so much attention. Lecture 7.—The interference and coincidence of sonorous waves, and the theory of "beats." Lecture 8.—The conditions of musical consonance, the harmony of musical sounds, and the optical examination of musical intervals.

The work is well illustrated for an English scientific book, and the style is agreeable, yet the book is more for the student than for the general reader; nine out of ten well-educated persons unacquainted with science could not comprehend many of the subjects discussed without reference to other works bearing on the subject. As a handbook for the student of science it is a valuable contribution to our scientific literature.

Traité Eléméntaire de Physique. Par A. PRIVAT DESCHANEL, Ancien Professeur de Physique au Lycée Louis-le-Grand. Paris: Hachette et Cie. 1869.

DURING the last few years, there has issued from the French press (and notably from the press of Messrs. Hachette) a series of beautifully-illustrated works, having for their object the popularisation of science. We need not do more than refer to "Le Ciel," and "Les Phénomènes de la Physique" of M. Guillemin, with their beautifully-coloured plates, their copper-plates, and their innumerable woodcuts. The recently-translated "Vie Souterraine" of M. Simonin is another example. In fact, the world has shown its appreciation of these works by the rapidity with which translations have been made into numerous languages. We saw the other day an "edition de luxe" of Guillemin's "Le Ciel" in Greek; and we should suppose that, by this time, it is to be found in Hindoostanee, perhaps in Chinese. There is no denying that we have no books among our native scientific literature which can compare with these: somehow our drawings of apparatus are heavy and cold, there is nothing artistic about them, and they are too often repellent to the eye, rather than attractive.

The book before us, although not belonging to the class of "Le Ciel," boasts three coloured plates, and 719 woodcuts in its thousand and eight pages. It is rather a student's manual than a popular work on physics. The subject matter is arranged in the following order:—Mechanics; Hydrostatics; Pneumatics; Hydraulics; Heat; Electricity; Acoustics; Optics. "Le traité," says M. Deschanel, "que je publie aujourd'hui est destiné à faciliter le travail des jeunes gens qui veulent obtenir ces grades" (universitaires), and, coming as it does from a man who, for nearly twenty years, was Professor of Physics in the Lycée Louis-le-Grand, it is a valuable contribution to French educational works.

Although by no means overloaded with mathematics, we are glad to observe the introduction of mathematical formulæ, wherever it is possible, without adding a great complexity to the matter discussed.

In the "Pneumatics," we notice an account of M. Kravogl's mercury air-pump, also of that of Geissler, but we seek in vain for mention of the admirable Sprengel pump.

The chapters on Heat are good, and are clearly written, but we think an insufficient mention has been made of Tyndall's experiments on the absorption and radiation of heat by gases, while the space devoted to the mechanical theory of heat is undeniably too short.

A good account, accompanied by a capital drawing, of the "machine à gaz" of MM. Otto and Lungen will be found on p. 306, and of the electrical machine of M. Holtz on p. 357. The subject of static electricity has been discussed with perhaps more diffuseness than any other subject. In dynamic electricity, we notice a very clear exposition of the actions of solenoids.

A chapter is devoted to the "Effets calorifiques produits par les courants," in which will be found a charmingly artistic drawing of the magnified "image des charbons" of the electric lamp; and, while we are on the subject of the woodcuts, let us mention No. 576 ("Propagation du son dans un milieu indefini") as singularly felicitous and elegant.

Of the book as a whole, we may say that we cordially recommend it to the student of science; he will find it clear and concise, abounding in good woodcuts, and remarkably moderate in price.

CORRESPONDENCE.

EXPLOSION OF NITROGLYCERINE.

To the Editor of the Chemical News.

SIR,—The frightful explosion of three-quarters of a ton of nitroglycerine in Wales, last week, and the deplorable loss of life and injuries attending it, may probably lead to some consideration on the part of the authorities as to whether an explosive agent apparently so unsafe should be allowed to be imported, or even used, in this country, notwithstanding that it appears to be established, at least to the judgment of many competent authorities, that for blasting a certain class of rocks there is no other agent at once so cheap in proportion to power and so effectual as nitroglycerine. The explosion referred to does not appear to have been the result of any carelessness; the "oil" was packed in metal canisters, which were surrounded by sawdust, and no one who has experimented with nitroglycerine can well attribute the explosion to any concussion that could have been caused by the jolting of the waggon in which it was conveyed, over, even, a somewhat rough road. Must, then, this explosion be classed with that which took place in Australia when the oil was at rest in a cellar? It would seem so. But if so, no confidence can be felt in employing an agent which may go off at any time; and the risk to life and property incurred in using it, will overbalance any possible advantage to be derived from its economy and efficiency.

Yet it is stated that nitroglycerine is *safer* than gunpowder. It is certainly less liable to be exploded by fire, and to disrupt the slender link which retains its elements, subject to chemical force, and set its mechanical force at liberty, by concussion, needs that concussion be sudden and forcible. I believe that a bottle full of blasting oil may be dashed to the ground without much danger, yet a drop of it upon a stone may be exploded by a blow from a hammer. Now what can be the possible cause of such unexpected explosions as have taken place? I can see only two possible reasons—First, that the oil undergoes decomposition or chemical change under certain at present unknown conditions, of time, temperature, shaking, &c., which predispose it to undergo a complete and sudden decomposition from causes ordinarily inadequate; secondly, that the cases and bottles in which it is contained, being air-tight, are liable, from a very trifling escape of gas from the liquid, to arrive at a state of tension from which the passage to a sudden break is easy. But would the mere bursting open of a bottle or tin case produce concussion sufficient to determine an explosion of the oil, unless we suppose the latter to be altered in quality? I think it would. I have known a stout glass bottle, used in an ethyl experiment, to be shattered by slowly gathered internal pressure into *dust*, with a report like the firing of a pistol. In a close vessel, full, or very nearly full of the oil, not much gas relatively to the quantity of liquid need be evolved in order to induce such a degree of pressure as might cause explosive rupture of the vessel. If one vessel burst, the concussion would certainly explode also any that might be near.

If the true cause of these seemingly anomalous explosions is indicated above, the remedy is both simple and inexpensive. Let every vessel containing the oil have fitted to it a tube, with a capillary bore, such as a piece of thermometer tubing, one end of the tube entering the oil, the other exposed outside.

If the tube were enlarged below to make room for any expansion of the liquid by elevation of temperature, none could be forced out by that alone, and none could be spilt through the capillary orifice of the tube by inverting the vessel. With a little management in the arrangements, any overflow might be made certainly indicative of the formation of permanent gases, which would be a warning signal. This method might also be applied experimentally—

to determine the probability or otherwise of the suggestion I have made as to the cause that may have led to these fearful explosions.

Certainly, the time is come when science should, in the cause of the public safety, investigate the "why" and the means of prevention of such horrors as that of the late catastrophe.—I am, &c.,

E. S.

Ramsey, Isle of Man,
July 7, 1869.

THE CHEMICAL SECTION OF THE BRITISH ASSOCIATION:

THE OFFICIAL REPORT.

To the Editor of the Chemical News.

SIR,—On comparing the official report of my paper entitled "Researches on the Ethers," with my paper as it appeared in the CHEMICAL NEWS some time ago, I was astonished to find striking differences between them.

In justice to you as well as to myself, I beg to state that the version which you have published is the authentic version, and that in the official one the alterations have been made without my knowledge. Possibly I may bring this matter before the Exeter meeting of the Association.—I am, &c.,

J. ALFRED WANKLYN.

London Institution.

MISCELLANEOUS.

Ashberrium, a New Alloy, consists of 80 parts of tin, 14 of antimony, 2 of copper, 2 of nickel, 1 of aluminium, and 1 of zinc.—*Polyt. Centr.*

New Alloy for Stereotyping.—M. Ed. Hofer-Grosjean recommends the use of an alloy, consisting of lead 50 parts, tin 36, cadmium 225; this alloy is readily fusible, and is harder than the alloy containing bismuth now applied for stereotyping purposes.—*Polyt. Centr.*

Mineral Lemonade.—When equal parts by weight of strong pure sulphuric acid and strong pure alcohol (85 to 90 per cent) are carefully mixed (the acid being poured into the alcohol and thoroughly mixed therewith), a liquid is obtained which has long been known and used by medical men under the older name of *Elixir acidum halleri*, more recently named *Mixtura sulphurica acida*. This fluid, which, if well prepared, contains essentially sulphovinic acid, is an excellent summer beverage when mixed with water in the proportion of one small teaspoonful to a tumbler of cold water, and sweetened with sugar, or, preferably, with some fruit syrup. Above the lemonades made with vegetable acids, this acid mixture has the advantage of not increasing the perspiration, as citric and other vegetable acids do, while, it is better borne by the stomach, and has a tonic action upon the vascular system. It is, indeed, a very pleasant drink, often given, at the *cafés* of Paris, Berlin, Vienna, and other places, along with some *syrop de groiselles* or *framboises*, and rather exorbitantly charged for. The proportions by bulk are—one of strong sulphuric acid and three of alcohol.—*Hamm's Agronomische Zeitung.*

Cellulose in Old Wood.—M. Payen has taken the trouble to analyse a piece of old woodwork, once belonging to the well-known Chaillot pumps, in order to ascertain what state the cellulose was in, after fully a century's exposure to wind and weather; he therefore treated the wood—first, for eight consecutive days, with a weak solution of caustic potassa (1 part in 10 of water), at a temperature of between 20° and 75° C.; secondly, he treated the residue with nitric acid, sp. gr. 1·2, without applying heat, and also for eight days; next with nitric acid, sp. gr. 1·05, taking care to wash out carefully all substances which, by each of these operations, could have become soluble, previous to proceeding with another operation; M. Payen obtained pure cellulose, as might have been expected, and was evidently also expected by Field-Marshal Vaillant, who happened to be present when the *savant* deposited, at a meeting of the Agricultural Society, a piece of pure cellulose obtained from the wood of the old pump, since the Marshal asked Payen, jocosely, whether he had not some old wood from the ruins of Carthage to operate upon; and M. Robinet, improving upon the occasion, offered to send Payen a piece of the wood of Noah's Ark, to continue his researches.

Fusibility and Volatility of Metals.—While engaged with experiments on the intrinsic composition and constitution of various pieces of silver money, made at the Royal Netherlands Mint, at Utrecht, Dr. A. von Riemsdyk carried on some experiments on the fusibility and volatility of metals, from the published record of which we abstract the following:—The metals tin, bismuth, cadmium, lead, and zinc, as chemically pure as they can be obtained, were molten, in order to prevent their oxidation, in a feeble, but constant, current of pure and dry hydrogen gas. The author found that—(1) the melting of these metals does not, either mechanically or by evaporation, give rise to any loss at all; (2) that *tin*, *lead*, and *bismuth*, when kept in a liquid state, are not volatile at temperatures greatly in excess of their melting points, and that, at a bright red heat, quantities of 2·3433 grms. of *bismuth*, and 4·3183 grms. of *lead*, did not lose, by being kept at that temperature for one hour, more than 1 and 0·5 m.m., respectively, by evaporation, while *tin* did not exhibit any volatility at all; (3) that *cadmium* and *zinc*, though completely fixed, non-volatile, at their melting point, begin perceptibly to volatilise at a few degrees above that point; (4) that there does not exist any relation at all between the fusibility and volatility of these metals, which may be arranged in the following manner, beginning from the most fusible and most readily volatile:—

Fusibility.		*Volatility.*
Tin	228·5° C.	Cadmium.
Bismuth	268·3° „	Zinc.
Cadmium.. ..	320·0° „	Bismuth.
Lead	326·0° „	Lead.
Zinc	420·0° „	Tin.

(5) that the so-called Rose's fusible metal, an alloy of tin, lead, and bismuth, the melting point of which is about 97·5°, and certainly not higher, is not perceptibly volatile when heated to a bright red heat in a current of pure hydrogen gas. Silver, unalloyed, melts at 1040° C., pure gold at 1240° C., while the author found that chemically-pure copper requires a temperature of 1330° C. to become liquid. Neither pure silver, nor pure copper, nor also the alloy of silver and copper containing 945-1000ths of the former metal (this alloy is the standard alloy of the Netherlands silver coins), loses anything at all by volatilisation when kept for a considerable time at temperatures higher than the melting points of both these metals, and in a feeble current of pure hydrogen to prevent their oxidation. The author has made some of these experiments on a very large scale, having at his disposal large quantities—several hundred kilos.—of these metals in pure and alloyed state; he also describes an ingenious pyrometer devised and invented by him, but space forbids us to enter into further details.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, vol. lxix., No. 1, July 5, 1869.

A very considerable portion of this number is filled with a lengthy discussion on some ancient letters and papers of historical interest. Incidentally with this subject, M. Balard stated that, having made use of M. Carré's plan to immerse written papers in dilute hydrochloric acid (one part, by bulk, of acid, to ten parts of pure water), he found very old writing to resist, even for fully twenty-four hours, the action of this acid, and that, although the figures become rather yellowish, they were perfectly and distinctly legible; yet, though this holds good for the documents operated upon, which were written between the years 1577 and 1770, it does not for documents tested in the same manner and written between the year 1793 and 1867. The observation was made that some ancient writing turned red in the acid; and, since this indicated the use of logwood in the ink, it was doubted whether this material had ever been applied at so remote a date as even the end of last century for ink making. M. Balard stated that he had found, in books printed and published more than 100 years ago, prescriptions to make black writing ink with logwood. M. Chevreul asked M. Balard whether he had tested the inks for oxide of manganese, since some prescriptions for the manufacture of black writing ink advise the addition of a salt of the protoxide of this metal, in order thereby to have a means of detecting any attempt to destroy the writing by means of chlorine. M. Chevreul pointed out the great difficulties in testing, by such methods, any writing, owing to the composition of the ink, the kind of paper, whereon it is written, its sizing, and the very varying conditions wherein written documents may have been kept.

Researches on the Galvanic Battery, and the Origin of the Heat which is Produced in the Elements and is not Transmissible to the Conducting Wires.—M. Favre.—This is another portion of a lengthy memoir on this subject, and is full of a series of

tabulated results, which cannot be left out without impairing the value of the research; we therefore only quote the title.

Poisonous Properties of Coralline, as used for Dyeing Purposes.—M. Tardieu.—This author, although not wishing directly to contradict M. Laudrin, insists upon the fact that silk stockings, dyed with coralline, and absolutely free from any such substances as arsenic, mercury, or lead, cause, to those who wear these on their feet, in many instances, grave inconvenience, certainly not due to the silk, and thus, inferentially, due to the dye.

Heat of Transformation of some Isomeric Bodies.—MM. Troost and Hautefeuille.—This memoir, a physico-chemical essay, treats of—1st, the heat of transformation of cyanic acid into cyamelide; 2nd, the heat of transformation of cyamelide into cyanuric acid; 3rd, on the relation which exists between the heat given off by the combustion of a substance and its specific gravity (under this head, sulphur and arsenious acid are treated).

Relations which Exist between Amido Acids, derived from Benzoic Acid, and the Alkaloids derived from Toluen.—M. Rosenstiehl.—The author says, there exist three acids, the composition of which is expressed by the formula $C_7H_5(NH_2)O_2$; they are—the *amido-benzoic*, *amido-dracylic*, and *anthranilic acids*; we are acquainted, moreover, with only two homologous alkaloids—to wit, *toluidine* and *pseudo-toluidine*. In order to elucidate the question, What relation there exists between these acids and the alkaloids, the author has acted upon these acids with hydriodic acid at a temperature of from 180° to 200°. The amido-benzoic acid yields pure toluidine, without any secondary product; amidodracylic acid yields pseudo-toluidine, but a secondary reaction takes place simultaneously, whereby carbonic acid, aniline, and hydride of methyl are formed; anthranilic acid behaves as amido-dracylic acid.

Solubility of Sulphur in Coal-Tar Oils.—M. Pelouze.—The author has operated with light benzines, sp. gr. 0·870 to 0·880, the former boiling between 80° and 100°, the latter between 85° and 120°; heavier benzines, sp. gr. 0·882 to 0·885, the former boiling at from 120° to 200°, the latter at from 150° to 200°; heavy oils, sp. gr. 1·010 to 1·020, the former boiling at from 210° to 300°, the latter at from 220° to 300°. The temperatures at which the solvent action upon sulphur was tried with these divers liquids, varied from 15° to 130°. The light benzines dissolve in the range of temperature up to their boiling point, from 2·5 per cent to 27 per cent of sulphur; the heavy benzines dissolve, for the same range of temperature, from 2·5 per cent to 38·7 per cent of sulphur; while the heavy oils dissolve in a range of temperature, from 15° to 110°, from 6 to 115 per cent of sulphur, and above 110° to 130°, indefinite quantities of that metalloid. At temperatures ranging from 200° to 300°, sulphur decomposes the heavy oils, sulphuretted hydrogen being set free.

Les Mondes, June 17, 1869.

We notice from this paper, in the first place, the few, but interesting words written by the Rev. Father Secchi, S.J., to M. F. Marzo, at Turin—

On Electricity.—"I believe that the true theory of electricity will result from the principle that electricity is not a motion (*mouvement*), but a change of the quantitative and dynamic equilibrium of the ether which constitutes the atoms of the substances, and that the propagation of such a change is brought about by the moving of the ether from one atom to another; this motion shakes, disturbs the ether of the atoms, and thus produces heat."

Balances of Great Precision.—It appears that the celebrated physical instrument makers, Collot, Frères, Paris, have greatly improved the mode of making balances, by devising what is called a balance on two columns. Without reproducing the woodcut contained in the above-named periodical, it is not easy to describe this instrument so as to be clearly understood by our readers; the system is an entirely new one, and by its application only is it possible to place the point of support on the axis of the balance, and thereby to shorten the length of the arms which bear the weight. Among the particulars mentioned of balances made according to this new system, we quote a balance made to bear, in each pan, 35 kilos., and sensitive with that load for 5 milligrms., and possessing, at the same time, perfect stability. Several balances of this kind have been made for the Russian Government; and the University of Upsala, Sweden, has two balances, each to carry 1 kilo. in each pan, and sensitive for 1½ milligrm. The laboratory of the School of Mines, Paris, has received, from MM. Collot, a balance of precision which, the author says, excels anything hitherto made. Balances with aluminium beams have also been introduced by these makers.

Among the acknowledgements of books received, we notice brief reviews of two small pamphlets, written and published in Italian, by the Rev. Father Secchi, S.J. The first of these books is entitled "*The Prismatic Spectra of the Heavenly Bodies*." Contents—1st, the prismatic spectra of the fixed stars; 2nd, the catalogue of the stars of which the luminous spectrum has been determined; 3rd, description of the instruments applied in this investigation. The work is illustrated with beautifully-executed engravings, and is, according to the opinion of the reviewer in *Les Mondes*, an almost herculean labour, executed with a care and precision which might, at first sight, appear to be beyond the powers of one man. The other work is on "*The Nebula of Orion*," and is rather an astronomical essay.

Researches on the Propagation of Sulphuretted Hydrogen Gas through other Gases.—Dr. Hilleb[illegible] this memoir, originally published in Swedish, has made a series of experiments with sulphuretted hydrogen gas, because it is very readily detected, and its presence shown among other gases; these experiments fully confirm what is already well known on this subject.

June 24, 1869.

This number contains more information on the subject of the—

Oxyhydrogen Illumination.—L'Abbé Moigno.—This paper is written with the express view of meeting the objections made in public prints against this mode of procuring artificial light, and answers each objection completely. The first objection, made and refuted, concerns the alleged difficulty which oxygen is supposed to have, of passing readily through pipes, and travelling therein with ease, on account of its high specific gravity; the author states that experience has proved that, under the same, and, in all respects, identical conditions, oxygen gas travels more rapidly than hydrogen. Another point is an objection concerning the comparative rare occurrence of peroxide of manganese, and the difficulty of obtaining it; to this the reply is, there is plenty of manganese, of excellent quality, readily accessible, and more than fifty times as much as any greatly-increased demand will ever absorb; moreover, the oxygen is made from permanganate of soda, which, it appears, is revived again after having yielded its oxygen. One ton of this permanganate yields in twenty-four hours 100 cubic metres of oxygen; and, from reliable data obtained, 300 tons of the salt will suffice to produce yearly about 10,000,000 cubic metres of oxygen gas (a cubic metre is equal to 35·3316 cubic feet). These 300 tons of permanganate are composed of 150 tons of soda, and 150 tons of peroxide of manganese, an insignificantly small quantity, compared with the 60,000 tons which are consumed of this material annually. As to the too slow production of oxygen, the author says, at the oxygen gas-work, when in regular course of working, they have obtained, from each retort, 38 cubic metres of pure gas per day; as to the cost, he states that the gas-work intended to be established will cost, everything included (retorts, &c., gas-holders to hold 24,000 cubic metres of gas for twenty-four hours' supply, 32 kilometres' length of mains), 3,700,000 francs; as to the objection concerning the zirconia, or magnesia cones, these last for several days, and only cost one centime; at the same time, the glass chimneys and globes are dispensed with. As to the expense of this gas, it appears, from the statements of the author, that, taking into consideration the great quantity of light obtained, it is decidedly less expensive. The manufacture of hydrogen, by means of the patented process, from hydrate of lime, is, according to the author, very simple, and the pure hydrogen thus obtained costs less than two centimes per cubic metre, leaving even out of the question the sale of the by-products, which would not be trifling. Lastly, the author tells us that MM. J. Dumas (Senateur, &c.), Jamin, Balard, and H. Sainte-Claire Deville, all Members of the Institut; M. Debray, of the French Imperial Mint; and M. Alphand, Director of Public Roads and Promenades, have been appointed a committee, by M. Haussmann, Préfet du Département de la Seine, to inquire into, and minutely report upon, this subject in all its aspects and details.

July 1, 1869.

We learn from this number that M. Wurtz, of Paris, has been on an inspection journey to Germany, by order of the Minister of Public Instruction, to report upon the chemical laboratories of Germany, and to give his opinion as to the progress of chemistry made in that country. The lengthy report of the eminent Doyen de la Faculté de Médicine of Paris may be summed up in these few words—That the material aid given to chemistry in Germany, has developed that science there to a degree which it lacks in France, as well as in most other countries. It is not for want of zeal and industry, says the eminent *savant*, but for want of the material aid—good laboratories, plentifully supplied with all requisites—that we are behind, as compared with Germany.

Cyanide of Potassium in Blast Furnaces.—M. H. Pajot has made a series of experiments, on the large scale, at the blast furnaces of Randonnay, Département de l'Orne, and found that the fact announced now many years ago, by Messrs. Lyon Playfair and Bunsen, of the presence of cyanide of potassium in blast furnaces, is a reality, and that the salt is formed there in such large quantities that it might easily become a useful and plentiful by-product of ironworks.

Extension of Sulphuric Acid Manufacture.—M. Perret.—The enormous pyrites deposits of Chessy and St. Bel, France, are advantageously applied, by the owner of that mineral deposit, to manufacture, at five different sulphuric acid works, a quantity of no less than 100 tons of concentrated acid daily, exclusive of the simultaneous manufacture of a great many other chemicals, in the preparation of which sulphuric acid is used. The pyrites alluded to contains a sufficient amount of copper to make the extraction of that metal from the burnt pyrites a paying business. This mineral is largely exported from France into those places where it can be taken to at a remunerative price; the locality where the mineral is found is too far away from the sea or any readily navigable river thither to admit of its exportation being extended beyond the limits of localities on and near the Franco-Swiss and Italian frontiers.

The Journal of the Franklin Institute, May, 1869.

Among the Editorial Items and Novelties we meet with the following original communications:—

[illegible]ght.—Prof. O. A. Rood.—Many years since, the author [illegible]h was made, at Berlin, of the well-known bronze [illegible]on; and it was observed that, in the negative, a

black streak occurred at the tip of the lance (held by the figure in an almost vertical position) while two other analogous marks appeared in other locations. This picture was sent to Prof. Dove (Berlin), whose investigations in connection with light are widely known, and he came to the conclusion that these markings might be due to electrical discharges going on from prominent points of the figure at the time the picture was taken, and which, though invisible to an observer, would, nevertheless, by reason of the high actinic power of electric light, produce an impression on the photographic plate. This conjecture has been fully confirmed by the author, who, in a series of ingenious experiments, proved that electric discharges, entirely invisible to the observer in the presence of daylight, might, nevertheless, produce images of themselves in a picture of the adjacent objects taken at the same time, the photographic plate being relatively more sensitive to these impressions than the human eye. The author describes at length his mode of experimenting; but, without a reproduction of the woodcuts illustrating this paper, it is not possible to enter into more details on this subject.

New Arrangement of the Holtz Machine.—Prof. Smith.—In the ordinary mode of excitation of the Holtz machine, the knobs of the dischargers are placed in contact, and afterwards separated; the excitation cannot be produced without contact. It follows, that, when the balls are separated beyond the striking distance, all action will suddenly cease, and, to renew it, the balls must again be brought together; and frequently, in addition to this, a new excitation of the sectors will be required. A large class of electrical experiments require, virtually, this separation of the balls beyond the striking distance—*e.g.*, the "electrical flyers," the "head of hair," and the insulating stool. The author fully explains his arrangement, so as to keep up an unlimited excitation, whatever be the number of points applied to the prime conductor, or whatever may be the distance of the balls of the dischargers; and, in order to excite the machine, it is not necessary that the balls should be in contact. We cannot, without woodcuts, give more details from this paper.

The greater part of the remaining papers of this number treat on matters of engineering, or are reproductions from papers found in European periodicals, among which the CHEMICAL NEWS occupies a prominent place.

Moniteur Scientifique, No. 300, June 15, 1869.

The greater part of this periodical is occupied with translations of papers taken from English and German periodicals already noticed by us. Among the original papers relating to natural sciences, excluding physiology, medicine, and natural history, we meet with a paper—

On the Rotatory Equivalent of Cane Sugar and Rock Crystal in their bearing upon Optical Saccharimetry.—M. Dubrunfaut.—The author states that the figure, 16·471 grms., which in the year 1850 was adopted as the correct unit for optico-saccharimetrical experiments, is wrong, and has been afterwards altered to 16·350 grms.; he next adduces, as proof of the necessity of a revision, also, of that last figure, some experiments of his, recently made with samples of sugar kept as standards at the French Ministry of Commerce. The author further alludes to the impurities of refined sugar as the cause of these errors, and finally states that, when a really well-made optical saccharimeter is used, and pure sugar, the figure 15·976 grms. represents truly the absolute rotatory equivalent of rock crystal as well as of pure cane sugar. The author quotes the results of an analysis of refined sugar, purified by him, by means of pure absolute alcohol, as follows, in 100 parts:—Ash, 0·00039; water, 0·00030; glucose, 0·00018; and traces of lactic acid. It appears, however, that M. Dubrunfaut is entirely unacquainted with the extensive series of experiments made on this subject in the Netherlands by Profs. G. J. Mulder, P. Harting, and F. C. Donders, and at Breslau by Dr. Duflos and M. Schloesser.

Among the subjects of *brévets d'invention*, we notice—

A Process of Preserving the Yolk of Eggs, patented by M. D'Andiran-Kœchlin, consisting in adding to the previously-broken-up yolks of eggs (the white being entirely separated and applied for the purposes of calico-printing), after having been dried, from 3 to 5 per cent of common salt, and one part per 1000 of arsenious acid. This yolk is not intended for food, but for the glove and wash-leather making factories; it is kept in air-tight vessels, filled without leaving any air whatever inside, and a couple of drops of pure carbolic acid are added to every litre of this homogeneous fluid.

To three gentlemen, has been granted a *brévet* for—

The Extraction of Benzine and its Homologues from Illuminating Gas obtained from Coals.—The precise process is not described; but, although it is certainly true that illuminating gas contains, by weight, ten times as large a quantity of benzine as does the coal-tar obtained at the same time, it is equally true that this benzine cannot be withdrawn from gas intended to serve the purposes of yielding good artificial light without greatly injuring its qualities in that aspect.

Improved Mode of Manufacturing Glucose from Starch.—M. Maubré.—The author states that, by the usual mode of proceeding, a portion of the starch is always left in the state of dextrine; he therefore operates under pressure and a higher temperature. For this purpose, he applies a strong cylindrically-shaped iron vessel, internally lined with lead; this boiler is charged with 28 kilos. of sulphuric acid, at 60° Beaumé, and 2800 litres of water, and this liquid is brought to the boiling point by means of high pressure steam. When boiling, there is gradually run into this fluid a mixture of 1180 kilos. of starch and 2500 litres of water, acidulated with 28 kilos. of sulphuric acid. When the whole of this quantity has been introduced into the aforesaid boiler, it is closed, and the temperature within it raised to 160°, by means of high pressure steam introduced into the boiler by leaden and perforated pipes. After about four hours, the action is complete, the fluid run off into tubs, and the acid saturated by means of 84 kilos. of finely-powdered good limestone. After separation of the sulphate of lime, the fluid is evaporated to 20° B., clarified with animal charcoal, and next evaporated in vacuum pans, yielding an excellent and beautiful glucose.

No. 301, July 1, 1869.

The only original paper contained in this number, is on the—

Platinising of Looking-Glasses.—M. Jouglet.—This paper, a very verbose and lengthy dissertation on a comparatively-speaking very trivial subject, appears to have been written with the view to bring forward a peculiar kind of manufacturing process, which, if it is attended with any improvement at all, will receive, no doubt, full justice at the hands of the public, who may be trusted to distinguish whether the covering the back of plate-glass with a thin layer of platinum is an advantage over the silvering, or amalgamating, generally applied for this purpose. The process itself does not seem to contain any novelty, and is described in this paper in a tediously-puffing style.

Cosmos, July 3, 1869.

New Dye from Madder.—Prof. Rochleder, at Prague, has found that, when madder is treated with dilute mineral acids, it yields, beside alizarine and purpurine, a small quantity of a third tinctorial substance, which, in alkaline solution, has a great similarity to chrysophanic acid dissolved in alkaline solution; acids precipitate it from this solution in the amorphous flocculent shape, the precipitate being of a pale yellow colour. This substance is soluble in alcohol and in acetic acid, and crystallises from these solutions, on the evaporation of the solvent, yielding orange-yellow coloured crystals; its aqueous solution mixed with acetic acid, and brought to boiling point, imparts to silk and wool immersed in that bath a beautiful and durable golden-yellow colour.

July 10, 1869.

This paper contains, as usual, a variety of information. The only note suitable for our readers is—

On the Seat of the Hygroscopic Properties of Silk.—M. Suida.—It is a well-known fact that crude silk is very hygroscopic; and some doubt has existed as to whether the exterior gum-like varnish of the raw silk, or the interior fibroine, was the chief seat of this great avidity for moisture. The author has taken a certain quantity of one and the same kind of silk (the avidity for moisture is by no means the same for all silks the produce even of one and the same country, and therefore it was necessary to operate upon one sample of known and the same origin), a portion of which had been deprived of its natural gum, while another portion was in its native state. The result of very carefully-instituted experiments is, that the fibroine—that is to say, the essential fibre of the silk itself, and not its tegumentary parts, gum chiefly, are the seat of the hygroscopic properties of raw non-dyed silk; the process of dyeing materially altering the fibre, also affects its hygroscopic properties. In 100 parts of silk, according to Mulder's analysis, the only extant, this substance consists of:—Fibroine, 53·37; gelatine, 20·66; albumen, 24·43; wax, 1·39; yellow colouring matter, 0·05; resinous and fatty matters, 0·10; this analysis refers to yellow (naturally coloured) silk from Naples. White native silk from the Levant was composed, in 100 parts, of—Fibroine, 54·04; gelatine, 19·08; albumen, 25·47; wax, 1·11; resinous and fatty matters, 0·30.

Bulletin de la Société Chimique de Paris, June, 1869.

From the *procès verbal* of the meeting of this society, held on the 16th of April last, we quote the following:—

M. Lefranc, a pharmaceutical chemist of the French army, presented to the Society a printed pamphlet—

On Atractylic Acid and Atractylates.—This acid is a naturally-existing compound sulpho-acid, met with in the *Atractylis gummifera* as a potassa salt; it is split up, by the action of acids, into sulphuric and valerianic acids, glucose, and a resin.

M. Tollens stated at the meeting that the well-known reaction of hypochlorite of lime and aniline is interfered with by the presence of ammonia, or any salt thereof, and that then the reaction only takes place when a large excess of chloride of lime is applied.

The following original papers are published in this number:—

Action of the Electric Spark upon Marsh Gas.

Direct Union of Free Nitrogen and Acetylene, and the Direct Formation of Hydrocyanic Acid.

Both these papers having been read by the author, M. Berthelot, also at meetings of the Academie des Sciences, have been already noticed by us; this remark equally applies to the next paper, by the same author—

Formation and Decomposition of Sulphide of Carbon.

Chemical Equilibrium, and the Influence of Pressure as Affecting the Action of Carbon and Hydrogen upon each other.—M. Berthelot.—The chief result arrived at by the author is that, when the pressure varies continuously, the equilibrium between carbon

and hydrogen changes by sudden shocks, thereby following rapports which are the multiples of the one and the other.

Essence of Sassafras.—Messers. Grimaux and Ruotte.—The essential oil of sassafras, obtained from the *Laurus sassafras*, is, when recently rectified, a colourless fluid, which, at 0° C. (32° F.), has a specific gravity of 1·0815. The oil is a mixture of a hydrocarbon and an inactive oxygen-containing principle; this latter consists, in 100 parts, of—Carbon, 74·43; hydrogen, 6·46; oxygen, 19·11. It is present in the natural oil in so small quantity that only just sufficient for a good elementary organic analysis was obtained. The hydrocarbon (safren) contains $C_{10}H_8$, and consists, in 100 parts, of—C, 88·23; H, 11·77. Its vapour density has been found equal to 4·84. Safren boils at about 156°. The oil further contains safrol, $C_{10}H_{10}O_2$, boiling at between 231° and 233°. Safrol is insoluble in water. Its specific gravity is 1·1141 at 0°; at −20° it is not frozen. The authors have studied the action of bromine, of hydriodic acid, of perchloride of phosphorus, and nitric acid upon safrol, but state that none of these reactions gave such results as they expected. With bromine, safrol yields a compound of the formula $C_{10}H_8Br_2O_2$.

Presence in the Air of Active Oxygen, or Ozone.—M. Houzeau.—The author demonstrates, at great length, in this paper that the air of the country is of a different character from that of towns; that the former is strongly disinfectant, has far greater bleaching power, and, especially after rainfall, affects bright and oxidisable metals far more than is the case in towns. This paper is not intended as a fully-demonstrative memoir, but in it the author calls attention to some facts readily observed, as, for instance, the rapid bleaching of all kinds of woven fabrics, be they made of linen, cotton, or woollen fibre; the rapid fading of very many dyed tissues; the far more active rusting of iron, steel, and even copper, in the country as compared with large towns. Curiously enough, the author does not mention the well-known fact of the effects of the air at sea, even at comparatively short distances from the shore, nor, also, the peculiar effects produced by the mountain air at no greater height than from 2000 to 6000 feet above sea-level.

Bromide and Iodide of Propionyl.—M. Sestini.—The specific gravity of the bromide of propionyl is, at 14°, equal to 1·465; its boiling point is about 97°; water decomposes it; formula, C_3H_5OBr. The iodide of propionyl boils at 127°: its specific gravity is far greater than that of water, in contact with which it is decomposed instantaneously; formula, C_3H_5OI.

Soluble Albumen which is not Coagulated by Heat.—Dr. Monnier.—We have already noticed this communication, but have to rectify the name of the author's place of residence, which is not *Lyons*, but *Nyon* (a town in the Département de Drôme); the *Deutsche Industrie Zeitung*, from which our abstract was made, had printed *Lyons*.

Use of Phosphate of Soda for Removing Manganese out of Solutions wherein Zinc has to be Estimated Volumetrically.—M. Renard.—The author states that he dissolved 1 grm. of zinc in hydrochloric acid, added thereto 0·6 grm. of chloride of manganese; next ammonia was added, and after that phosphate of soda; the result of his volumetrical estimation of zinc in this solution came to 0·998 grm. of zinc. When the addition of phosphate of soda to a solution of precisely the same composition as the one alluded to was omitted, the quantity of zinc was found to amount to 1·036 grm. The ferrocyanide of potassium process was used in these experiments.

The remaining pages of this periodical are filled with abstracts and translations from English, German, and American periodicals, and with abstracts from the *Comptes Rendus*. The large majority of these are taken from works published during the course of last year; most of them have been already noticed by us.

Journal für Praktische Chemie, No. 6, 1869.

This periodical opens with a very lengthy and exhaustive essay on the

Affinity between Solution of Acetate of Iron without Change of State of Aggregation.—Prof. A. Müller.—This memoir is subdivided into several chapters, and has a series of tabulated forms added: it is not well suited for abstraction.

Chemical Researches of the Eozoon Stone of Raspenau, in Bohemia.—Dr. R. Hofmann.—The stone here alluded to appears to be a serpentinoid mineral, embodied in a kind of dolomite, of which the composition, in 100 parts, is as follows:—Carbonate of lime, 58·815; carbonate of magnesia, 40·20; peroxide of iron, 4·291; insoluble in HCl, 1·261; water, 0·083; traces only of phosphoric acid. The shell of the eozoon stone consists, in 100 parts, of—Carbonate of lime, 97·711; carbonate of protoxide of iron, 1·660; carbonate of magnesia, a trace; alumina, 0·629; minute traces of phosphoric acid. The central portion of the inner part of the eozoon stone has a specific gravity of 2·687, and consists, in 100 parts, of—Water, 7·092; silica, 36·425; alumina, 32·944; protoxide of iron, 20·140; lime, 0·678; potassa, 2·721.

Dolomitic Limestone of Cheynov, near Tábor, in Bohemia.—Dr. R. Hofmann.—This limestone is deposited among and embedded in gneiss; it varies in composition as well as in specific gravity, the latter having been found as low as 2·711, and as high as 2·861; its extremes of composition, in 100 parts, are as follows:—Carbonate of lime, 98·418, and 57·809; carbonate of magnesia, 0·009, and 39·186; protoxide of iron, 0·346, and 0·628; peroxide of iron and alumina, none in either sample; insoluble in hydrochloric acid, 1·167, and 2·377.

Composition of Hauyn.—Prof. A. Kenngott.—This is a purely mineralogical paper.

Basic Salts of Zinc and Copper.—M. Franz Reindel.—The author says that, when a boiling solution of sulphate of zinc containing an excess of that salt is treated either with a solution of caustic or carbonated alkalies, precipitates are formed which, both in consequence of their composition and of their peculiar behaviour towards reagents, deserve the attention of chemists. It has often been stated that pure $CuOCO_2$ may be obtained by decomposing 1 equivalent of $CuOSO_3$ with 1 equivalent of $NaOCO_2$. The author has digested the mixture obtained as result of this reaction for one month with a concentrated solution of soda in the cold, and has not been able thus to obtain, even after very careful washing out, a product entirely free from sulphuric acid. The basic sulphate of zinc obtained by boiling a solution of sulphate of zinc in excess with ammonia constitutes a white powder, which, on being washed with water, is steadily but very slowly decomposed; the fluid running off from the filter has an acid reaction, and contains sulphuric acid as well as oxide of zinc. The author gives, in this lengthy and still unfinished paper, several analyses of basic salts, obtained under a variety of conditions, and dried at temperatures varying from 110° to 260°, whereby the quantity of water of these salts is reduced, but not eliminated, for some of these salts lose water up to a red heat.

Influence of Water upon some Siliceous Minerals.—M. A. Cossa.—The minerals submitted to experiment were two kinds of gneiss, syenite, several kinds of trachyte, granite, and basalt. They were reduced to powder, and left for ten days in contact with twenty-five times their bulk of pure water, at a temperature of from 17° to 18°; the filtrates were evaporated to dryness, and, after having been moistened with hydrochloric acid, again evaporated, and the dry residue weighed as chlorides. The weight of these residues varied from 0·0567 per cent to 0·35 per cent of matter dissolved.

Annales de Chimie et de Physique, April, May, and June, 1869.

We do not separately notice each of them, for the reason that the last essay which concludes the number for May is continued through that of June, but not yet concluded.

The April number of this periodical opens with a portion of M. Friedel's essay on the Acetons and Aldehydes, which is concluded. Next we meet with a biographical notice of M. Sadi Carnot, by Le Comte Paul de Saint Robert. Next follows—

Researches on Resins.—M. Sacc.—The author observes that resins have been very little studied at all; and his researches recorded in this paper extend to copal, amber, dammar, colophony, lac (or shellac), elemi, sandarac, mastic, and carnauba wax (a resin). The author has studied the more or less degree of readiness wherewith resins are reduced to powder, the action thereupon of boiling water, of alcohol of 86 per cent strength, of ether, of ordinary acetic acid, of a hot solution of caustic soda of 1·074 specific gravity, of sulphide of carbon, of oil of turpentine, of boiled linseed oil, of benzine, of naphtha, of sulphuric acid of 1·83 specific gravity, of nitric acid of 1·329 specific gravity, and of caustic ammonia. All resins were applied in powdered state; and the solvents three times as large a bulk as that of the resins have acted for at least twenty-four hours, at temperatures varying between 15° and 22°. The general results arrived at are briefly as follows:—All resins submitted to experiments fuse quietly when heated, excepting amber, shellac, elemi, sandarac, and mastic, which swell up, and increase in bulk. Only the carnauba wax melts in boiling water; colophony becomes pasty therein, while dammar, shellac, elemi, and mastic agglutinate. Copal, amber, and sandarac do not change. Alcohol does not dissolve amber nor dammar; agglutinates copal, partly dissolves elemi and carnauba wax; while colophony, shellac, sandarac, and mastic are readily soluble therein. Ether does not dissolve amber and shellac; makes copal swell, and partly but slowly dissolves carnauba wax; dammar, colophony, elemi, sandarac, and mastic are readily dissolved therein. Acetic acid does not dissolve amber and shellac; causes copal to swell; somewhat acts upon carnauba wax, and does not at all act upon any other of the resins above named. Caustic soda solution readily dissolves shellac, difficultly colophony, and has no action upon the rest. In sulphide of carbon, amber and shellac are insoluble: copal swells therein; elemi, sandarac, mastic, and carnauba wax are difficultly dissolved therein, while dammar and colophony are readily so. Oil of turpentine has no action upon amber or shellac; causes copal to swell up; dissolves readily dammar, colophony, elemi, sandarac, carnauba, and very readily mastic. Sulphuric acid does not dissolve carnauba wax; all other resins are dissolved and coloured brown, excepting dammar, which becomes bright red. Nitric acid does not act upon the resins, but colours carnauba wax straw-yellow, elemi a dirty yellow, and mastic and sandarac bright brown. Ammonia does not dissolve some of these resins, but causes copal, sandarac, and mastic first to swell, afterwards dissolving them; colophony is easily soluble therein.

Researches on the Composition and Structure of Meteorites.—M. S. Meunier.—A very interesting and elaborate essay on this subject, but too long for proper abstraction.

On a Pump provided with a Free Plunger (*pompe à piston libre*).—M. le Marquis de Montrichard.—A physico-mechanical paper.

Pyro-Electric Properties of Crystals which are Good Conductors of Electricity.—M. C. Friedel.—The abstraction of this paper, without the re-production of the large number of woodcuts essentially belonging thereto, would be useless.

Nitriles of the Fatty Acids.—M. A. Gautier.

Neues Jahrbuch fur Pharmacie, von Dr. F. Vorwerk, April, 1869.

We notice the following original papers:—

On Cytisin, an Alkaloid of the Genus Cytisus.—Dr. A. Husemann.—The seed, bark, and root of the well-known laburnum tree (originally from Switzerland, but now dispersed throughout Europe), *Cytisus laburnum*, L., contains, it appears, an alkaloid, which has been isolated by the author, and is described by him as a white crystalline solid substance, of bitter and somewhat caustic taste, soluble in water and alcohol, and hardly soluble at all in ether, chloroform, benzol, and sulphide of carbon. Cytisin is a strong basic substance, precipitating many metallic combinations from their solutions, and setting free ammonia from its compounds. Its composition, in 100 parts, is:—C, 73·84; H, 8·30; N, 12·92; O, 4·94; formula, $C_{20}H_{27}N_3O$. The nitrate of cytisin is a readily-crystallisable salt.

The other original paper is one belonging strictly to botany. Among the miscellaneous papers met with in this periodical, we meet with a communication—

On the Varieties of Tapioca and Sago Prepared in the Malaccas.—It appears that, at the request of the resident Governor of the Malacca Islands, researches have been instituted concerning this food, at the Laboratory, at Welte Vreden, Java. The authors of this paper, MM. Maier, Moens, and Scharlec, found that three varieties of sago, denominated white, red, and blue, contain, respectively—water, 16·14, 18·83, and 18·47 per cent; protein compounds, respectively—3·7, 2·5, and 2·4 per cent; starch, fat, &c., respectively—79·88, 78·06, and 78·15 per cent; ash, respectively—0·22, 0·22, and 0·94 per cent.

The remainder of the miscellaneous in this number are of no special interest to our readers.

Bibliothèque Universelle et Revue Suisse.—Archives des Sciences Physiques et Naturelles, No. 137, May 15, 1869.

The original papers of this number of this periodical are confined to—

A Note on the Aurora Borealis of the 15th of April, 1869.

On Berberis Vulgaris.—M. Schnetzler.

Experimental and Theoretical Researches on the Equilibrium Figures of a Liquid Mass not Possessed of any Weight.—M. Plateau.

No. 138, June 15, 1869.

This periodical contains an astronomical paper, unsuitable for abstraction here, and no other original papers: being filled with translations of memoirs taken from *Poggendorff's Annalen*, and other periodicals of that description, the papers having been alluded to and quoted by us already.

Chemisches Centralblatt, No. 20, May 19, 1869.

This number does not contain any original papers or communications.

Bayerisches Industrie und Gewerbeblatt, March and April, 1869.

The greater part of this double number is filled with "Dasr Berggesitz für das Königreich Bayern"—that is to say, a very lucidly and perfectly-made law (act of parliament) for the regulation of everything connected with mining, quarrying, and the extraction, from the earth, of minerals, including coal, limestone, and also building materials, &c., for the kingdom of Bavaria.

Boring of Wells, and the Water Supply to Large Towns.—M. Kieser.—This is a rather lengthy, but highly interesting, essay, on a subject of very great importance.

Experiments on the Bleaching of Wood Pulp for Paper Manufacture.—Dr. C. Winkler.—Neither chlorine, bromine, nor any substances the activity of which is due to oxidation, were found by the author to answer the purpose, the result always being the production of a decidedly yellow, and sometimes even brown, tinge. Sulphurous acid does not completely answer the purpose; the destruction of the natural colouring matters by means of fermentation did not lead, also, to any good result.

Effect of Temperature of the Air upon the Illuminating Power of Burning Coal Gas.—M. A. Vogel.—From this lengthy essay we only notice that, when the illuminating power of ordinarily good coal gas is equal to 100 at 18°, it is only 76 at 0° and 33 at −20°.

May, 1869.

This number chiefly contains officially-published matter, among which are very minute directions for the assay of gold and silver articles of *bijouterie* and the use of proof or touch needles in testing the quality of pure gold and silver contained in articles presented for assay to the parties appointed for this purpose; all such assayers have to pass a very strict examination in general and practical chemistry, and especially in the assay of gold and silver by the dry, and also the wet process, as far as the latter metal is concerned. The touch-needles alluded to are made at the Munich mint, uniformly for the seven assay districts into which the kingdom of Bavaria is divided. This number does not contain any original papers relating to chemistry, or sciences closely related thereto.

NOTES AND QUERIES.

Isinglass.—Can any of your correspondents inform me of any method of obtaining isinglass, by mixture or otherwise, in the form of a powder.—ICTHYOC.

Crystallisation of Supersaturated Solutions.—Will any of your courteous readers kindly furnish an enquirer, who is greatly interested in the subject, with a list of the bodies which are found to act as nuclei in determining the crystallisation of supersaturated solutions?—R. C. C.

Water Analysis.—I have just finished examining a spring well in the country, and found on evaporating one imperial gallon of the water to perfect dryness, the residue weighed 102 grains, and afterwards ignited and lost by ignition 40 grains. Besides, I found there exists 10 grains N_2O_5 in one gallon. Now I should like to know if it is the rule to deduct the whole, or only a part of this nitric acid, from the loss by ignition when drawing up a report, or how should I act?—J. WALLACE.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1817. K. Brown, Glasgow, N. B., "Improvements in the manufacture of iron."—Petition recorded, June 14, 1869.

1832. W. Smith, Bathgate, Linlithgow, N. B., "Improvements in heating or purifying mineral oils."—June 18, 1869.

1855. T. Routledge, Ford Works, near Sunderland, "Improvements in the preparation of materials for the manufacture of paper."—June 16, 1869.

INVENTIONS PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF COMPLETE SPECIFICATIONS.

1850. G. W. Fox, Manchester, "Improvements in the treatment of castor, cod-liver, and other medicinal oils, in order to render the same more palatable."—Petition recorded, June 16, 1869.

1868. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved process for preparing sulphates, and obtaining fine silver therefrom."—A communication from F. Gutzkow, San Francisco, California, U. S. A., June 17, 1869.

1884. H. A. Bonneville, Chaussée d'Antin, Paris, "Compounding and applying certain compounds, to render fabrics water repellent." A communication from R. O. Lowry, Salem, Washington, N.Y., U.S.A.—June 19, 1868.

NOTICES TO PROCEED.

426. G. F. Ansell, Bernard Street, Russell Square, Middlesex, "Improvements in the manufacture of steel and iron."—Petition recorded, February 11, 1869.

434. H. Edwards, Staple Inn, Holborn, Middlesex, "An improved preserved food."—February 12, 1869.

469. L. N. Legras, Wardour Street, Middlesex, "Improvements in the preservation and disinfection of animal and other substances, and in the apparatus employed therein."

477. F. Walton, Staines, Middlesex, "Improvements in the manufacture of artificial leather."—February 16, 1869.

540. W. Ibotson, New Inn, Strand, London, W. W. Ladelle, Wraysbury, Bucks, and A. G. Southby, Bulford House, near Amesbury, Wilts, "An improved method of, and apparatus for, preparing esparto, straw, rags, or other materials for the manufacture of paper."—February, 22, 1869.

781. J. Thomlinson, Carlisle, Cumberland; and W. Thomlinson, Loughborough, Leicestershire, "Improvements in the manufacture of paper and texile fabrics, and in the preparation of gypsum, to be used in such and other manufactures."—March 13, 1869.

836. J. Thomas, Middlesborough-on-Tees, W. Bacon, Newcastle-upon-Tyne, and H. Groves, Redcar, Yorkshire, "Improvements in the manufacture of iron and steel, and in furnaces and apparatus employed therein."—March 19, 1869.

1202. L. Goetz, Leith, N.B., "An improved preparation of materials for cleansing wool, cotton, linen, and other like fibrous substances."—A communication from G. Müller, Neussadt-on-the-Haardt, Bavaria—April, 20, 1869.

1721. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of iron."—A communication from J. Burt Detroit, Michigan, U.S.A.,—June 3, 1869.

1800. G. W. Oliver, Liverpool, "Improvements in the manufacture of explosive powder, and in machinery to be used in such manufacture."—A communication from P. A. Oliver, New York, U.S.A.—June 10, 1869.

ERRATA.—In 502, July 9th, p. 13, line 27, from the top, *for* physiologist *read* philologist; p. 13, line 28 from the top, *for* Indic, *read* Indo-; p. 14, line 24 from the top, *for* κυηστ- *read* κυηστ-.

THE CHEMICAL NEWS.

VOL. XX. No. 504.

RESEARCHES ON VANADIUM.*

BY HENRY E. ROSCOE, B.A., Ph.D., F.R.S.

PART II.

On the Chlorides of Vanadium and Metallic Vanadium.

IN the first part of these researches ("Bakerian Lecture," *Phil. Trans.*, 1868, pt. i.) the author stated that the chlorides of vanadium, and probably also the metal itself, could be prepared from the mononitride, the only compound of vanadium not containing oxygen then known. The process for obtaining the mononitride described in the last communication was that adopted by Berzelius for preparing the substance which he conceived to be metal, but which, in reality, is mononitride. This method consists in the action of ammonia on the oxitic chloride; but it cannot be employed for the preparation of large quantities of nitride, owing to the violence of the action and consequent loss of material. The author, seeking for a more economical method, found that if the ammonium metavanadate (NH_4VO_3) be heated for a sufficiently long time at a white heat in a current of dry ammonia, pure vanadium mononitride remains behind. Analysis of a sample thus prepared gave 79·6 per cent of vanadium and 20·2 per cent of nitrogen, theory requiring 78·6 and 21·4 per cent respectively. The mononitride may likewise be directly prepared by igniting vanadium trioxide (V_2O_3) in a current of ammonia at a white heat in a platinum tube, and also by subjecting the dichloride to the same treatment.

The Chlorides of Vanadium.—Three chlorides of vanadium have been prepared, viz.:—

Vanadium tetrachloride ..	VCl_4
Vanadium trichloride ..	VCl_3
Vanadium dichloride.. ..	VCl_2

1. *Vanadium Tetrachloride*, VCl_4, molec. wt. = 193·3, V.D. = 96·6 (H = 1).—This chloride is formed as a dark reddish brown volatile liquid, when metallic vanadium or the mononitride is burnt in excess of chlorine. The first method adopted for the preparation of this chloride was to pass dry chlorine over the mononitride heated to redness; the whole of the nitride volatilises and a reddish brown liquid comes over. In one operation 44 grains of the crude tetrachloride was thus prepared; the liquid is purified by distillation, first in a current of chlorine and then in a stream of carbonic acid gas. On fractionating, the liquid was found to boil at 154° C. (corrected) under 760 m.m. of mercury. The second method depends upon a fact already noticed in the preceding communication, that the oxitrichloride ($VOCl_3$), prepared, according to the directions of Berzelius, by passing dry chlorine over a mixture of the trioxide and charcoal, possesses a port-wine colour instead of the canary-yellow tint of the pure substance. This dark colour is due to the formation of the tetrachloride of vanadium, and if the vapours of the oxytrichloride, together with excess of dry chlorine, be passed several times over a column of red-hot charcoal the whole of the oxygen of the oxychloride can be removed, and at last perfectly pure tetrachloride, boiling constantly at 154°, is obtained. This reaction, it will be remembered, served first to demonstrate the existence of oxygen in the oxytrichloride. In each distillation of the tetrachloride a peach-blossom coloured solid residue remained in the bulbs; this substance is vanadium trichloride, and it slowly burns away in excess of chlorine when heated, forming tetrachloride.

The composition of the tetrachloride was established by six well-agreeing analyses, made from several different preparations. The mean result is:—

	Calculated.	Found.
V = 51·3 ..	26·54 ..	26·87
Cl_4 = 142·0 ..	73·46 ..	73·02
193·3	100·00	99·89

Owing to the facility with which the tetrachloride splits up into trichloride and chlorine, a solid residue was left in the vapour-density bulb, and the density of the vapour (at 219°) was found by Dumas's method to be 99·06 (or 6·86) instead of 96·6 (or 6·69). By volatilising the liquid in a small bulb, and allowing the vapours to pass into a large bulb already heated above the boiling-point of the liquid, this deposition of trichloride was avoided, and the density was found to be 96·6 or 6·69 at 205°, and 93·3 or 6·48 at 215°, the last determination indicating that a partial decomposition into VCl_3 and Cl had occurred. The specific gravity of the liquid tetrachloride at 0° is 1·8584; it does not solidify at −18°, nor does it at this or any higher temperature undergo change of properties on treatment with chloride. It not only undergoes decomposition on boiling, but at the ordinary atmospheric temperatures it splits up into VCl_3 and Cl. Tubes in which the liquid chloride had been sealed up have burst by the pressure of the evolved chlorine. Thrown into water, the tetrachloride is at once decomposed, yielding a blue solution identical in colour with the liquid obtained by the action of sulphurous or sulphydric acids on vanadic acid in solution, and containing a vanadous salt, derived from the tetroxide V_2O_4. In order to prove that a vanadous salt is formed when the tetrachloride is thrown into water, the solution thus obtained was oxidised to vanadic acid by a standard permanganate solution. The calculated percentage of oxygen thus needed, according to the formula

$$2VCl_4 + O + 4H_2O = V_2O_5 + 8HCl$$

is 4·14; the percentage of oxygen found by experiment was 4·11.

The solution of the tetrachloride in water does not bleach; but if the vapour be led into water a liquid is obtained which bleaches litmus. Vanadium tetrachloride acts violently on dry alcohol and ether, forming deep-coloured liquids. The author is engaged upon the examination of this reaction.

Bromine and vanadium tetrachloride, sealed up and heated together, do not combine; on the contrary, trichloride is deposited. Hence it is clear that vanadium does not readily form a pentad compound with the chlorous elements.

2. *Vanadium Trichloride*, VCl_3 = 157·8.—The trichloride is a solid body, crystallising in splendid peach-blossom coloured shining tables, closely resembling in appearance the crystals of chromium sesquichloride. It is non-volatile in hydrogen, and, when heated in the air, it decomposes, glowing with absorption of oxygen, and forming the pentoxide. Heated in hydrogen, the trichloride first loses one atom of chlorine, forming the dichloride (VCl_2), and afterwards, on exposure to a higher temperature, loses all its chlorine, leaving metallic vanadium as a grey lustrous powder. The trichloride is extremely hygroscopic, deliquescing on exposure to air to a brown liquid. The trichloride is best prepared by the quick decomposition of the tetrachloride at its boiling point, or by its slow decomposition at the ordinary temperature of the air. The crystalline powder obtained by either of these methods only requires freeing from adhering tetrachloride, by drying in carbon dioxide at 160°, in order to yield good analytical results.

* Abstract of a paper read before the Royal Society, June 17, 1869.

	Calculated.	Mean of 4 analyses.
V = 51·3	32·5	32·57
Cl_3 = 106·5	67·5	67·42
157·8	100·0	99·99

The trichloride thrown into water does not at once dissolve; but, as soon as the crystals get moistened, a brown solution is formed, which becomes green on addition of a drop of hydrochloric acid, and contains a hypovanadic salt in solution. This green tint is identical with that got by reducing a solution of vanadic acid in presence of magnesium. According to the equation—

$$2VCl_3 + O_2 + 3H_2O = V_2O_5 + 6HCl$$

the solution of the trichloride requires 10·14 per cent of oxygen to bring it up to vanadic acid, whilst analysis showed that 10·1 per cent was necessary. The specific gravity of the trichloride at 18° is 3·00.

3. *Vanadium Dichloride*, $VCl_2 = 122·3$.—The dichloride is a solid, crystallising in fine bright apple-green micacious plates. It is prepared by passing the vapour of vanadium tetrachloride mixed with hydrogen through a glass tube heated to dull redness. If the heat be pushed further, a blackish crystalline powder, consisting of a mixture of lower chloride and metal, is obtained. The dichloride, when strongly heated in hydrogen, loses all its chlorine, leaving vanadium in the metallic state in grey crystalline grains. Analysis gave :—

	Calculated.	Mean of 2 analyses.
VCl = 51·3	41·95	42·16
Cl_2 = 71·0	58·05	57·88
122·3	100·00	100·00

Vanadium dichloride is extremely hygroscopic; when thrown into water, a violet-coloured solution is formed, identical in tint with the liquid containing a hypovanadous salt obtained by reducing vanadic acid in solution in presence of zinc- or sodium-amalgam; and like this latter liquid, the solution of dichloride in water bleaches strongly by reduction.

Oxidised by permanganate, this liquid required 18·78 per cent oxygen (on the dichloride taken) to bring it up to vanadic acid, whereas the equation—

$$2VCl_2 + O_3 + 2H_2O = V_2O_5 + 4HCl$$

requires 19·6 per cent. The specific gravity of vanadium dichloride at 18° is 3·23.

Metallic Vanadium, V = 51·3.—Although from what we know of the characters of vanadium, it appeared unlikely that any compound containing oxygen would yield the metal by direct reduction, the author has repeated the experiments of other chemists on this subject, but without success. There is no doubt that the metal cannot be obtained by any of the processes described in the books. The only methods which promised possible results were :—

1. The reduction of a vanadium chloride (free from oxygen) in hydrogen gas, either with or without sodium.
2. The reduction of the mononitride at a white heat in hydrogen.

The first of these methods has proved to be successful, whilst the second does not appear to yield metal, inasmuch as the nitride exposed for 3½ hours in a platinum tube to the action of hydrogen at a white heat, lost only 8 per cent, whereas it must lose 21·4 per cent on conversion into metal.

Notwithstanding the apparent simplicity of the method, the author has found it exceedingly difficult to obtain the metal perfectly free from oxygen. This arises from the fact that, whilst vanadium is quite stable at the ordinary temperature, it absorbs oxygen with the greatest avidity at a red heat, and that, therefore, every trace of air and moisture must be excluded during the reduction. Another difficulty consists in the preparation of the solid chlorides in large quantity and free from oxygen or moisture, as also in the length of time needed to reduce these chlorides in hydrogen, during which time unavoidable diffusion occurs, and traces of oxygen enter the tube. Again, the reduction can only be effected in platinum boats placed in a porcelain tube, as the metal acts violently on glass and porcelain, and tubes of platinum are porous at a red heat.

A description of the apparatus employed is then given, the main points being to guard against diffusion, and to introduce the powdered dichloride into the platinum boat in such a way that it shall not for an instant be exposed to moist air. After all precautions are taken, the tube is heated to redness, torrents of hydrochloric acid come off, and the evolution of this gas continues for from 40 to 80 hours, according to the quantity of dichloride taken. After every trace of hydrochloric acid has ceased to be perceptible, the tube is allowed to cool, and the boat is found to contain a light whitish grey-coloured powder, perfectly free from chlorine.

Metallic vanadium thus prepared, examined under the microscope, reflects light powerfully, and is seen to consist of brilliant shining crystalline metallic mass, possessing a bright silver-white lustre. Vanadium does not oxidise or even tarnish in the air at the ordinary temperature; nor does it absorb oxygen when heated in the air to 100°. It does not decompose water even at 100°, and may be moistened with water, and dried *in vacuo*, or at 100°, without gaining weight. The metal is not fusible or volatile at a bright red heat in hydrogen; the powdered metal thrown into a flame, burns with the most brilliant scintillations. Heated quickly in oxygen, it burns vividly, forming the pentoxide; but slowly ignited in air, it first glows to form a brown oxide (possibly V_2O), and then again absorbs oxygen, and glows with formation of the black trioxide and blue tetroxide, till it at last attains its maximum degree of oxidation. The specific gravity of metallic vanadium at 15° is 5·5. It is not soluble in either hot or cold hydrochloric acid; strong sulphuric acid dissolves it on heating, giving a yellow solution; hydrofluoric acid dissolves it slowly with evolution of hydrogen; nitric acid of all strengths acts violently on the metal, evolving red nitrous fumes, and yielding a blue solution: fused with sodium hydroxide, the metal dissolves with evolution of hydrogen, a vanadate being formed.

One sample yielded on oxidation a percentage increase of 77·94, whereas that calculated from metal to pentoxide is 77·98. Another preparation gave a percentage increase of 70·8, showing the presence of a small quantity of oxide. On treatment in a current of chlorine, metallic vanadium burns and forms the reddish black tetrachloride; heated in a current of pure nitrogen, the mononitride is formed.

The properties of the compounds of vanadium with silicon and platinum are then described in the memoir.

ON

COLOPHONINE AND COLOPHONIC HYDRATE,

NEW SUBSTANCES PROCURED FROM THE PRODUCTS OF THE DESTRUCTIVE DISTILLATION OF RESIN.*

By CHARLES R. C. TICHBORNE, M.R.I.A., F.C.S., &c.

WHEN we submit to distillation (either with or without water) the natural exudations of the different pines, the first result is the extraction of volatile hydrocarbons, or oils of turpentine. These oils were, until very lately, considered as identical, but recent investigations have proved that there is a considerable disparity in the products from different species of the pines. If, after the extraction of the volatile oils, the distillation is pushed further, we get a second series of volatile compounds, which, however, differ materially from the first, inasmuch as they are de-

* Communicated by the author. Read before the Royal Irish Academy.

composition products, resulting from the splitting up of the colophony, or resinous part, into more simple molecules of different isomeric modifications.

All the resin oils obtained by myself gave the result I am now about to detail. I, however, believe that the discrepancies exhibited by the turpentines are perpetuated through the products obtainable upon the destructive distillation of the resins proper to such turpentines.

My attention was first directed to the substance which I have named colophine from an observation made preparatory to investigating the volatile oils procured on submitting resin to destructive distillation.

I took commercial resin, and, after drying for some time at a slightly elevated temperature, distilled it in an iron retort. I got, by this means, a thick distillate, which contained a considerable quantity of undecomposed resin. Gaseous products escaped which are said to contain ethylene, tetrylene, and marsh gas. The liquid products amounted to about 74 per cent of the resin employed, and a small coke was left in the retort. This thick oil, on rectification, gave about 5 to 6 per cent of a light yellow but mobile fluid, which is known under the names of "resin spirit," "vive essence," "Harzessenz."*

This lighter portion, or "resin spirit," is supposed to consist mainly of the hydrocarbons homologous of the series $C_n H_{2n-4}$ and $C_n H_{2n-6}$, and an oxygenated oil, which has been named colophonone.† It is these light oils that yield colophonic hydrate. They act energetically upon the fluid alloy of potassium and sodium, even when free from the last-named substance; therefore it is probable that colophonone, or other oxygenated oils, form a large ingredient.

It is given as a specific characteristic of colophonone, that, if it is treated with sulphuric or hydrochloric acid, a green oil separates on the addition of water. This is, however, only partially true; for I found that the "resin spirit"‡ procured in the above experiment, or old resin spirit that had been washed, only gave this reaction in a slight degree.

It was, therefore, evident that the colour-phenomenon was due to the presence of some other substance soluble in water, and not to a specific property of the colophonone. On treating old resin spirit with distilled water two or three times, and on evaporating these washings at a low temperature, a brown crystalline mass was procured, which gave the colour-reactions, hitherto attributed to the oil itself, in a most vivid manner. It therefore becomes evident that the whole subject of colophonone requires revision. It was probable that the substance analysed under that name was a mixture.

I subsequently obtained specimens of the new substance in which individual crystals had attained some considerable magnitude.

Some of them were 3 centimetres long, and over 2 grammes in weight. They were of an amber colour, from impurities, and were obtained by submitting a large volume (10 litres) of the spirit, in an imperfectly-closed vessel, to twelve months' slow evaporation and oxidation. I have procured as much as 281 grammes of the crude crystals from 4·5 litres of resin spirit by washing.

The following are the characteristics of this compound, which, when purified, is a truly beautiful substance:—

Colophonic hydrate is white, perfectly odourless, and has a sweetish taste; it is very soluble in water, alcohol, ether, chloroform, and tetrachloride of carbon; not quite so soluble in cold benzole and resin spirit, but slightly soluble in cold bisulphide of carbon.

Colophonic hydrate crystallises readily from water or alcohol, in beautiful acicular prisms, which sometimes attain some magnitude. Heated, it melts and sublimes, with a partial loss of the elements of water. The crystals which first sublime lose water, but nearly resemble those obtained from a solution, both as regards their appearance and composition. Those which afterwards rise (or if the first are re-sublimed) lose more water, and form hexagonal plates, or fern-like fronds, of great beauty. It was found impossible to accurately measure the large crystals already mentioned, the twelve months' immersion having rounded and worn the faces, from the rise and fall of temperature in the medium in which they are formed. They seem to belong to the dimetric system, and are the result of the combination of the two prisms of that system.

The hydrated crystals, when placed over sulphuric acid, or *in vacuo*, gradually lose water, and effloresce; but, as the substance is itself volatile, the loss could not be measured under such circumstances. When placed under a bell-glass over sulphuric acid, the surface of the acid becomes covered with a green film, produced, as will be afterwards explained, by the mutual action of the water, sulphuric acid, and colophonic hydrate. Some difficulty was experienced in procuring the anhydrous compound. From the above results, it was supposed that, on submitting the hydrate to sublimation, the water of hydration would be dissociated. Such, however, was not the case, and a combustion of the sublimed crystals pointed to no formula. The sublimate was, in fact, a mixture of the anhydrous and hydrated compounds.

The first of these substances I obtained in the following manner:—I gently fused, in a test-tube, for some time the crystals obtained from an aqueous solution, occasionally drying out the moisture which condensed at the top of the tube with bibulous paper. The sublimed crystals were repeatedly broken down, and mixed with the fused mass. This process was continued as long as moisture was given off. I retained the crystalline mass for analysis. It seemed to have suffered no decomposition, exclusive of dehydration, and formed a friable and nearly perfectly white substance.

On making a combustion of the above, 0·218 gramme gave 0·505 gramme CO_2, and 0·218 gramme H_2O.

In a second experiment, 0·307 gramme of the fused mass gave 0·7076 gramme of CO_2, and 0·324 gramme of H_2O.

These experiments point to the empirical formula $C_{10}H_{22}O_3$.

	I.	II.	Theory.	
Carbon	63·16	62·86	63·15	120
Hydrogen ..	11·10	11·72	11·58	22
Oxygen			25·27	48
			100·00	190

The crystals obtained from an aqueous solution gave, when burnt, the following results:—0·265 gramme of crystals produced 0·557 gramme of CO_2, and 0·270 gramme of H_2O.

		Theory.	
Carbon	57·35	57·70	120
Hydrogen ..	11·32	11·53	24
Oxygen ..		30·77	64
		100·00	208

Colophonic hydrate .. $C_{10}H_{22}O_3 : H_2O$.
Colophonine .. .. .. $C_{10}H_{22}O_3$.

Colophonine is, therefore, isomeric with terpine hydrate, or is, more properly, a homologue of terpine. It is another instalment towards filling up an interesting series. This compound is probably derived from terebene.

* Mr. J. Turner, a large distiller of resin, has kindly sent me the following notes regarding the statistics of the production of these oils on a manufacturing scale:—

	Percentage.
"Resin spirit" (boiling at 135° C.)	5·3
Heavy oils	64·6
Pitch	14·4
Gaseous products and H_2O	15·7

† Schiel.

‡ I shall use the term "resin spirit" throughout this paper, to designate the light oils got on rectifying resin oils.

Hydrocarbides.	Products formed therefrom by the occult molecule H_2O ("Turpentine Camphors.")	Hydrates.
$C_{10}H_{16}$, $C_{10}H_{16}$; ("Diterebene.")	$C_{10}H_{16}$, $C_{10}H_{16}$; H_2O.* ("Terpinole.")	
$C_{10}H_{16}$. (α) (Turpentine, or "terebenthene.")	$C_{10}H_{16}$; H_2O ("Liq. Turpentine Camphor.")	$C_{10}H_{16}$; $H_2O : H_2O$. Hypothetical hydrate, supposed transition products.
	$C_{10}H_{16}$; $2H_2O$. ("Terpine.")	$C_{10}H_{16}$; $2H_2O : H_2O$. (Terpine hydrate.)
$C_{10}H_{16}$. (β) ("Terebene.")	$C_{10}H_{16}$; $3H_2O$. (Colophonine.)	$C_{10}H_{16}$; $3H_2O : H_2O$. (Colophonic hydrate.)

In the above table, I have endeavoured to convey, by the punctuation, the accretion of the series, and the different degrees of molecular integration.

It will be observed that each hydrate would be isomeric with the next higher homologue in the camphor series. The hydrates to the first two in the series are wanting, but it is probable that they exist, as the compound called liquid turpentine camphor is, in the presence of water, converted into terpine, the isomer of its hydrate. If we do not suppose that the hydrate is first formed, we could hardly account for the formation of terpine.

Colophonic hydrate was violently acted on by bromine, accompanied by a copious separation of carbon and hydrobromic acid. In water, the action was more manageable, and the ultimate product was a brominated oil, which, after washing, first with a diluted solution of carbonate of sodium and then with water, was dried over sulphuric acid. 0·471 gramme of this oil, after being decomposed in a sealed tube with pure soda, was treated with an excess of nitric acid, and nitrate of silver. It gave 0·766 gramme of bromide of silver, agreeing very nearly with the formula of a tetrabrominated compound.

Professor Jellett, who kindly examined this substance for me as regards its optical properties, finds that it is perfectly inert when in solution, and possesses neither right nor left-handed rotation.†

As previously stated, the light oils from resin when treated with sulphuric acid, and then with water, produce a green substance. This colouration is, however, due to the presence of colophonic hydrate. On treating that compound with acids, a series of striking phenomena is exhibited, conjugated acids being formed, which exhibit a fine display of colours. The generality of these are green. Sulphuric, phosphoric (monobasic and tribasic), arsenious, citric, and tartaric acids give these reactions.

On treating the crystals with an excess of the acid, and then adding spirit, the colour is developed. It is necessary to use heat in most cases. The sulphuric acid reaction is capable of rendering evident a milligramme of the new substance, if properly applied. It is not necessary to use heat in this case. Under certain circumstances, hydrochloric acid is capable of producing this green reaction; but when colophonic hydrate is treated with an excess of strong hydrochloric acid, after the expiration of half-an-hour, a brilliant rose colour is developed on pouring it into alcohol. If the experiment is pushed further, different shades of violets are produced, until the ultimate result of the maceration is a magnificent indigo blue.

Terpine hydrates do not give any of these reactions. The coloured solutions give absorption spectra, represented by the accompanying diagram. The longitudinal lines *A*, *a*, *B*, *C*, &c., represent the position of the solar lines. The thickness of the dark bands represent intensity of absorption, in a similar manner to Bunsen's graphic method used for metal spectra. Fig. 1 is the spectrum seen on viewing an alcoholic solution of the sulphuric compound. Dr. Reynolds, to whom I showed this spectrum, noticed that, when the acid is first mixed, the spectrum shows an absorption between the lines *D* and *E*, β, Fig. 1; this, however, after a little time, begins to fade from its more refrangible end, the centre of the spectrum gradually clearing, until the band is lost, and the spectrum, Fig. 2, obtained, the band *a*, *a'*, being intensified. Hydrochloric acid spectra behave in a somewhat similar manner, the ultimate result, either from age or boiling, being a spectrum similar to Fig. 3, the bands *a*, *a'*, slowly fading. These results would lead to the inference that the normal colour is purple, which is afterwards converted into the green compound.

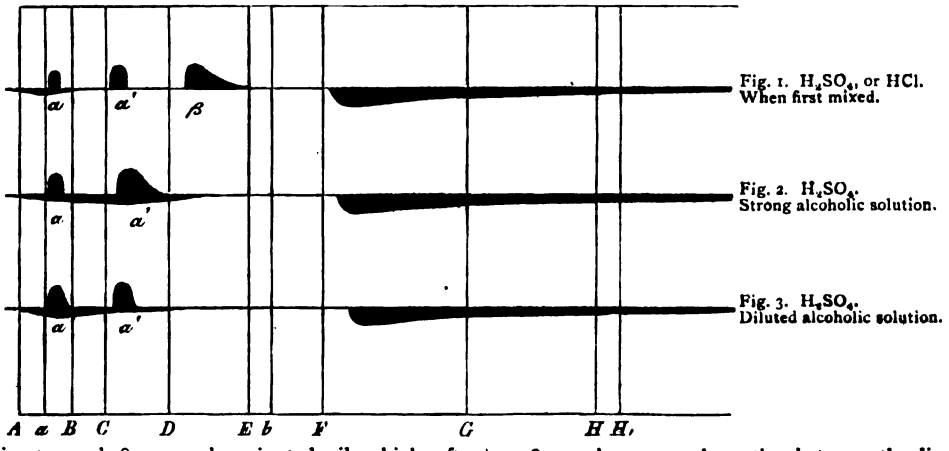


Fig. 1. H_2SO_4, or HCl. When first mixed.

Fig. 2. H_2SO_4. Strong alcoholic solution.

Fig. 3. H_2SO_4. Diluted alcoholic solution.

As regards the origin of colophonic hydrate, it is probably formed under similar circumstances to the terpine camphors, *i.e.*, by oxidation, or the assimilation of the elements of water. I have failed, however, in forming this substance artificially by oxidising the resin spirit with nitric acid.*

It is not present in newly-prepared resin spirit, as I have already explained; and, as my supply of colophonic hydrate was expended, my researches upon this substance were, I am sorry to say, brought to a close. It is, however, my intention to renew them at a future period.

* Formed by the action of dibromhydrate of citrene on acetate of silver—

$$2(C_{10}H_{16}Br_2) + 4(C_2H_3AgO_2) - 4(AgBr) - 2(C_2H_4O_2) - \left.\begin{matrix} C_2H_3O \\ C_2H_3O \end{matrix}\right\} O = \underset{(Terpinole.)}{C_{20}H_{32}O}.$$

Vide "Naquet's Principles," p. 396.

† It does not differ in this respect from its congeners the terpine hydrates, and similar products, in which, although the hydrocarbide preserves its integrity, its gyratory power is suspended.

* Mr. Turner forwarded me from England a bottle containing resin spirit, in which he had observed crystals. They proved, on examination, to be colophonic hydrate. The bottle originally contained about 8 ounces, but, from evaporation, only ½ an ounce remained; it consisted of about 25 per cent of colophonic hydrate. It had been exposed to sunlight for about eight years—light, however, is not essential to the formation of this compound.

CONTRIBUTIONS TO OUR KNOWLEDGE OF

NATURAL WATERS USED FOR DRINKING AND OTHER DOMESTIC PURPOSES.

Whatever can serve for the purpose just named cannot but be highly acceptable at a time when the question of water supply, purity of water, and the origin therein of substances deemed by some injurious, and indicating its contamination with the products of the decomposition of animal matter, is daily discussed. It is not our intention to enter upon speculative ground, but we will simply place before our readers a few facts, relating to the natural history of various kinds of water investigated by the Royal Committee appointed for the purpose of making a thorough inquiry into all matters relating to potable waters, and those used for domestic purposes, in the kingdom of the Netherlands, which facts, including chemical analysis, microscopic investigation of sediments, engineering, and geological matters, have been embodied in a printed report. We have selected those samples of water which, for their peculiarities in some respect or other, are best fit to bear especially also upon the question *how* and *whence* ammonia and nitrates, as met with in natural waters, are derived.

We have to call attention first to some facts which are, especially in this country, rather overlooked; to wit—(1) that, although the larger portion of the Netherlands territory in Europe is of comparatively very recent geological formation and consists of strata of very great permeability for water, that permeability exists in almost all kinds of geological formations, and, therefore, in all countries, hence the water of rivers, lakes, sea and other water-courses penetrates, to greater or less extent and depth, into the soil and contributes with the water fallen as rain and snow to fill the springs and more or less deep wells.

The second observation relates to an essential difference in the primitive source of the water of the British rivers as compared with, for instance, that of the Rhine; for the sake of illustrating what we mean, we will just briefly quote a few facts and figures, first about the Rhine, and next about the Thames. The Rhine has its sources in that portion of the Swiss Alps called the St. Gothard group, at an elevation above sea level of 9,967 feet; it is fed by the constantly melting ice and snow of the higher peaks of the Alps, and its three main constituent rivulets flow into one at Reichenau, at a height of 2021 feet above sea level; thence to the lake of Constanz or Bodensee the river takes its course over a hard, rocky bed; it traverses the lake just named, which, by-the-by, is exceedingly deep, and contains water of great purity. The direct course of the Rhine has a length of 415 miles, its basin has an area of 65,280 square miles, and its tributaries, large and small, number fully 12,000.

The Thames, although not the largest of British rivers, is, undoubtedly, the most important in many aspects beside commercial; it takes its origin from some rather insignificant brooks and rivulets near Cirencester; at Thames Head Bridge its level is 376 feet above that of the sea; its direct course to the Nore is 124 miles, and the area of its basin is 6,160 square miles. What is, however, of far more importance in this comparison of these rivers for our purpose, is the fact that, throughout its entire course, and especially previous to the point of bifurcation, the waters of the Rhine essentially retain that purity which gave rise to its being named in Switzerland, "*Reiner*" (purity). Dr. Von Planta Reichenau, an eminent Swiss *savant*, and the owner of large estates on and near the sources of the Rhine, has analysed its waters, taken at different seasons of the year and at different places of the course of this river, from Reichenau downwards to Emmerich, and has found that, what is in a very high degree the case with these waters at their primitive source, is retained in a very marked measu[illegible]length of the river's course, viz., that [illegible]ns, dissolved, a large and abundant quantity of oxygen: this, coupled with the fact that the large bulk of the water of this river is not, to any great extent, modified by the water of its tributaries, some of which are large streams also taking their origin in ice and snow, may have some bearing upon the very small quantity of organic matter and the infinitesimal small quantity of ammonia met with in the water of the Rhine.

Sufficient has been said to point out that there exists a primitive and essential difference between the sources of the supply of water of the Thames and Rhine to account for more impurity in the latter, while, moreover, the value of manure of all kinds is too greatly esteemed along the major portion of the course of the Rhine to allow fæcal matters and other refuse and offal to find its way into a river, the police of which, or, rather, *administration de la sureté publique*, about which is under the control, not of one state, but of that of France, Baden, Bavaria, Hesse-Darmstadt, Prussia, and the Netherlands, jointly, whereby proper care is also taken as regards the fouling of the river and the pollution of its waters. Except in the Netherlands, and excepting also the men who, while navigating the Rhine or its tributaries, drink of its waters, that water is not used for drinking purposes by the great bulk of the large population dwelling on the banks of that river, since excellent water of easier access than that of the river is readily to be had. The writer of this article had, last year, while in Germany, an opportunity of obtaining some information about the supply of water, quantity, and quality, in use by the large numbers of soldiers at Coblentz, Cologne, Wiesbaden, and other places; great care has been taken to insure a constantly plentiful supply, and, above all, of good quality, by boring deep wells. Notwithstanding, the river water is excellent to the taste, rather less saline, however, and is certainly better for washing purposes, neither the military nor civil population of the places just named, and others situated along the Rhine, Moselle, Lahn, Maine, &c., ever think of using the water of these rivers, which, in many instances, indeed, they would have to fetch at a comparatively great distance from their dwellings. The writer was also informed that the water obtained from the public pumps, pants, and fountains, was regularly submitted to analysis, and that the authorities took great care to keep wells, and tubing, and all works in proper repair, so as to insure good and wholesome water.

Turning now to our chief subject, we quote, in the first place, the results of analysis, and other particulars of the water of a canal at Zwolle. This canal is so connected with the Züyder Zee and tidal rivers that its level, by the effect of the flood and ebb, varies about 13 inches daily; the water was clear, pale yellow coloured, its taste somewhat similar to rain-water; on standing, it deposited a sediment, which, on being submitted to microscopic research, proved to contain not only minutely divided mineral matter, but also various infusoria, remnants of partially peatised vegetables, and small molluscs.

The result of the chemical analysis in this, as in every following instance, refers to *one* litre of the water, and the quantities are expressed in grammes—Total solid residue, 0·181; organic matter, 0·020; sulphate of lime, 0·0087; carbonate of lime, 0·0008; alkalies, 0·066, consisting chiefly of chlorides without any sulphates; ammonia, 0·00023; nitrates or nitrites, none; colour of dry residue, yellow before ignition, grey after. This water is not liked for drinking or domestic purposes, but occasionally used.

Water from a Pump at Groningen.—The well supplying this water is in very permeable soil; from the surface to a depth of 2·7 metres, layers of peaty soil are found; next follow sand and gravel. At 3·5 metres distance from the pump, an open sewer—a dirty ditch—runs. The water of the well is undoubtedly partly surface-water. Its physical properties are—Dark yellow colour; somewhat milky turbidity; taste not disagreeable, but very vapid. The microscopical examination of the sediment led to no other result than that structureless membranes were seen, which

disappeared when a single drop of dilute hydrochloric acid was added, causing, at the same time, effervescence. Analysis yielded the following results:—Total solid residue, 1·386; organic matter, 0·225; sulphate of lime, 0·1094; carbonate of lime, 0·6556; alkalies, 0·396, consisting chiefly of chlorides without any sulphates; ammonia, 0·00790; nitrates or nitrites, none; colour of dry residue before ignition, brown; after, black. Almost all who reside in the neighbourhood where this pump is placed detest the water; it is only used after having been left quietly standing for at least twenty-four hours, and then only after having been boiled and cooled again. At the time the water was taken for analysis, much rain had fallen. The city of Groningen is situated at a considerable height above sea-level, as compared with many other places of the kingdom.

Water taken from a Brook situated near Leeuwarden, in the Alluvial Soil of the Sea formerly existing there.—The bottom of this brook consists, for about 2 metres depth, of a layer of partly-decayed fresh-water plants. At about 150 metres distance from the brook, a large dung-heap is permanently placed. Physical properties of this water—Nearly colourless; quite limpid; tastes like rain-water. After long standing, a very slight sediment is deposited, which, on microscopic investigation, was found to consist of very small molecules, and flocculent vegetable matter, containing the very lowest order of infusoria. Result of chemical analysis—Total solid residue, 0·5135 gramme per litre; organic matter, 0·0675; sulphate of lime, 0·0583; carbonate of lime, 0·2617; alkalies, 0·126, chiefly chlorides without any sulphates; no ammonia, and only very faint traces of nitrates; colour of residue before ignition, yellow; after, greyish black. This water is largely used by the inhabitants, and very well liked. At the time the water was taken for analysis, not much rain had fallen. The level of the water in this brook is 47 centimetres below A. P.,* which is about sea-level.

Water from a Pump at Dokkum.—This pump is placed on a now disused cemetery. The water is collected in an underground vault made of masonry. The level of the water is 2·45 metres below the surface of the pavement, and is evidently also fed by a canal which is situated at about 100 metres distance from the vault. No sewers are anywhere in the neighbourhood; but close to the pump is a building used as a school-house, and this place being unprovided with an urinal, the boys (200 in number) are in the habit of making their water outside the school, against the wall, in consequence whereof the soil in the immediate vicinity of the pump is saturated with urine. The water is about colourless, clear, and limpid, and not at all disagreeable to the taste. A sediment subsides after some time; and this, on being investigated with the microscope, was found to contain molecules of clay, very small vegetable seeds, and pieces of threads of white wool and blue cotton. Total solid residue, 1·6935; organic matter, 0·1550; sulphate of lime, 0·4669; carbonate of lime, 0·2831; alkalies, 0·7885, chiefly chlorides without any sulphates; no ammonia; no nitrates or nitrites; residue yellow before ignition, grey after. This water is not much used, except by the schoolboys. At the time the sample was taken for analysis, there had been a good deal of rainfall.

Water from a Canal called the Dedemsvaart, Province of Overijssel.—This water is derived from the extensive peat bogs, to which the canal gives ready access. Its colour is as dark as sherry, but it is limpid and clear; taste vapid and disagreeable. The sediment which subsides exhibits, when viewed under the microscope, a multitude of peatified vegetable substances and infusoria. Total solid residue, 0·131; organic matter, 0·080; sulphate of lime, 0·0146; carbonate of lime, 0·02854; alkalies, 0·021; no sulphates; ammonia, 0·00041; of nitrates rather a large quantity; residue brown, black after ignition. While burning, it gives off an odour resembling that of smouldering nitrogenised organic matter. No rain had fallen for several days when the sample of water for analysis was taken. This water is not used for drinking or domestic purposes.

Water from a Pump surnamed the "Staten Pomp," at the Hague.—This pump is placed close to one of the most ancient buildings in the said town, and stands on a comparatively high level. The level of the water in the well is about 5 metres below the pavement. A thin brick wall only separates this pump and well from an extremely foul and dirty canal, a rather large open sewer, which winds its course to a large canal named the "Spui." The water is rather turbid; does not become clear on standing; exhibits a yellowish colour; taste saline; no microscopic investigation. Total solid residue, 0·750; organic matter, 0·060; sulphate of lime, 0·0639; carbonate of lime, 0·1831; alkalies, 0·443; no sulphates of alkalies; ammonia, 0·01181; large quantity of nitrates; colour of residue before ignition yellow, after ignition grey. This water is largely used, and relished, by those who reside near enough to make it worth their while to fetch it.

Water from a Pump situated in the Cité Ouvrière belonging to M. Régout, at Maestricht.—This pump is of comparatively recent construction, is in good working order, and the well is built in by means of brickwork laid in strong hydraulic cement; a canal is at 159 metres distance. No infiltration of surface water, nor of the contents of a large underground sewage cistern, has been found to exist. The water is of excellent quality, quite clear, colourless, and pleasant to the taste. Total solid residue, 0·650; organic matter, 0·020; sulphate of lime, 0·043; carbonate of lime, 0·342; alkalies, chiefly as chlorides, 0·245; no sulphates of alkalies; no ammonia; no nitrates nor nitrites. The soil in and about Maestricht is full of fossils, and noted for having been the place where very interesting animal remains have been found, while, moreover, the town, in consequence of having been since at least three centuries a fortress, and having frequently been besieged for months together, is, in a sense, a vast cemetery, full of the human remains of soldiers killed during such sieges and interred within the town, which, however, is of large extent of surface. Colour of solid residue of water before ignition, pale brown; after ignition, greyish black. The water is largely used, and very much praised and relished.

Rain-water Collected at St. Annaland, Province of Zeeland, at no great distance from the Sea.—The water was taken from a large, well-made, underground cistern, used for storing the water, built of bricks and strong cement; the water, on falling on a tiled roof, is led by means of wooden spouts to the cistern, which is surrounded by sand and clay soil; the water was slightly coloured, somewhat turbid, but does not deposit a sediment; taste, the same as is usually experienced from rain-water. Total solid residue, 0·4775; organic matter, 0·055; sulphate of lime, 0·136; alkaline chlorides, 0·2085; alkaline sulphates, 0·004; no ammonia; a very faint trace only of nitrates; colour of residue, before ignition, pale yellow; after ignition, pale grey. The water is much used, since there is no other but brackish water, quite unfit for any use.

Water taken in the Middle of the River Merwede (a local name given to a portion of the Rhine after the river Maas has joined it near Woudrichem).—Off the town of Dordt, the river is at this point about 1200 metres wide, and rather deep. The water was taken about the middle of the month of March last year. The water was very turbid, did not become clear on standing, and its taste was disagreeable. Total solid residue, 0·160; organic matter, 0·040; sulphate of lime, 0·0355; carbonate of lime, 0·420; alkalies, chiefly chlorides, 0·0425; sulphates of alkalies, none; ammonia, none; of nitrates, a faint trace; colour of solid residue, before ignition, pale yellow; after, pale greyish. This water is largely used, but in many households it is filtered previously.

* A. P. stands for *Amsterdamsch Peil*, which is the starting point, or zero, from which all levels below or above are measured in Holland. This true and very accurately-determined point was first adopted at Amsterdam about the year 1680; and, after having been verified over and over again, has been, since 1818, adopted as the general zero of all levels in the country.

Water from a Well bored, in 1866, at the Hague, for the private use of a Manufactory.—Total depth of boring, 5·65 metres, passing through 1·05 metre of sand; 0·40 metre of blackish peaty soil; 1·0 metre pure peat bog; 0·70 metre sand and peaty veins; 1·50 metre bluish coloured sand; 1 metre white-coloured sand mixed with shells of molluscs; the water leaves 0·704 gramme to the litre of solid residue dried at 120° C.; organic matter, 0·198; carbonates of lime and magnesia, 0·192; chloride of sodium, 0·247; sulphuric acid, 0·006 gramme to the litre; no ammonia, and no nitrates nor nitrites have been detected in this water, although diligently sought for in a large quantity of water carefully evaporated to small bulk; the water is not colourless, but excellent to the taste, and the supply very abundant.

Results of the Analysis of Three Varieties of Water, obtained at Rotterdam by means of Norton's Well Tube, driven into a Layer of Whitish coloured Sand.—No. 1 well is 23 metres deep below sea level; No. 2 well has the same depth; No. 3 is about 14 metres below sea level. The physical qualities of these waters are good; the water has risen within the tube to about 1 metre below the surface of the mouth of the tube, which is level with the soil wherein it is driven.

	I.	II.	III.
Total solid residue ..	0·708	0·320	0·448
Organic matter	0·146	0·094	0·094
Carbonates of lime and magnesia	0·204	0·068	0·170
Chloride of sodium ..	0·098	0·029	0·093
Sulphates, calculated as SO_4	—	0·004	—
Ammonia	0·021	0·020	0·011
Nitrates..	Decided reaction.	Decided reaction.	Very strong reaction.

The analyses of the few samples of water selected for quotation from upwards of 300 analyses published in the report, represent the varieties of water used for domestic purposes in the Netherlands; to wit, rain-water, river-water, water from brooks and canals, water taken from more or less deep wells, sunk or bored, into the ground to more or less depth, but never reaching to layers of very solid, and never to what should be properly called rocky, material. The localities selected are situated many miles distant from each other. As regards the alkalies, potassa and soda, it should be observed, that while generally no sulphates of the same are met with, a portion of these substances is very frequently combined in the waters analysed with humic, ulmic, crenic, and apocrenic acids and other organic substances. The composition of the water of the great rivers, passing through the country, does not materially differ at any point of their course as long as that water remains potable, from not being within sea reach, when the samples are taken at the same period of the year.

SPECTROSCOPIC OBSERVATIONS OF THE SUN.*

By Lieut. J. HERSCHEL.

This letter, written from Bangalore, states that the author discovered a new line in the spectrum of the sun's rays, in the neighbourhood of G; the author determined its position without difficulty, with reference to the rest of that crowded group of solar lines, and found it identical with the thick line at 2796 of Kirchhoff's chart; while studying this newly-discovered line, the writer succeeded in distinctly seeing a fainter red flash, already described by Mr. Lockyer, and he also noticed another line (the 6th) between F and G. These lines are defined by the figures of the Greek alphabet, and their number and position indicated according to Kirchhoff's chart. The letter then enters into details of mode of observation, and proceeds to discuss an article by Mr. Huggins in the *Quarterly Journal of Science*. This part of the letter, however, is not suitable for abstraction.

* Abstract of a letter addressed by the Author to W. Huggins, F.R.S., and communicated by him to the Royal Society.

NOTICES OF BOOKS.

Laboratory Teaching; or Progressive Exercises in Practical Chemistry. By C. L. Bloxam. John Churchill and Sons. 1869.

We can scarcely imagine a man more competent to treat of laboratory teaching than Mr. Bloxam. Commencing his studies at the College of Chemistry, he soon became the first assistant there, and the work which he then brought out in conjunction with Mr. Abel has long been familiar to the student of practical chemistry; altogether, for no less than twenty-three years has Mr. Bloxam been a teacher of laboratory practice; hence we have before us no imaginative system, elaborated in the mind but unpractised in the laboratory, but a system of instruction based on—nay, entirely made up of—experience. And it is not alone the most efficacious mode of teaching practical chemistry which must result from lengthy experience, but an exact and elegant manipulative skill; and an ingenuity in devising processes and experiments are alone attainable by this means.

The work before us is quite devoid of any theory; there is not a formula or a symbol in the whole book; it is essentially a treatise on *practical* chemistry. It contains, in the words of the author—

(1). "A series of simple tables for the analysis of unknown substances of all kinds (not excepting organic bodies) which are known to be single substances, and not mixtures.

(2). "A brief description of all the practically important single substances likely to be met with in ordinary analysis, by which the learner may satisfy himself that his results are correct, and may, at the same time, become acquainted with the leading properties of the most important chemicals, and with the foreign substances which they are liable to contain.

(3). "Simple directions and illustrations relating to chemical manipulation, not collected into a separate chapter, but given just where the learner requires them in the course of analysis.

(4). "A system of tables for the detection of unknown substances with the aid of the blowpipe.

(5). "Short instructions upon the purchase and preparation of the tests, intended for those who have not access to a laboratory."

Mr. Bloxam describes the various processes of chemical manipulation with an extreme minuteness of detail, and always effects his object by the simplest means; thus he says, "When a mortar is not at hand, substances of moderate hardness may be powdered on a hard surface by rolling a bottle over them;" a piece of broken porcelain may be often substituted for platinum foil; and Bunsen's burners may be improvised by placing a funnel over and a little distance above an ordinary gas-burner. We think, however, that a crudity of operation, although safe in the hands of a careful and accomplished chemist like Mr. Bloxam, may lead to carelessness and a want of delicacy and cleanliness in the student; it may lead him to regard processes which require the utmost skill as more or less rough operations, in which a large margin may be left f error of action. To our mind, we cannot have too elab late or perfect apparatus for our infinitely delicate chemi

operations; we cannot warn the student too often against inattention to minute points of cleanliness in his operations; we cannot too often impress upon him the necessity of rendering assurance doubly sure—the double rinsing of his cleaned (and nominally clean) test-tubes, and other vessels, the examination of the purity of his tests, the infinite solicitude which he must give to his boiling liquid, or his filtering solution, lest one small drop—be it but so much as makes "the twentieth part of one poor scruple"—be lost; and, although in qualitative analysis the need for extreme caution is to some extent removed, we must remember that a careless habit once acquired is not relinquished when the student passes to quantitative analysis. We were in a laboratory the other day which, for neatness and cleanliness, not to say primness, might vie with a quaker's drawing-room; not a speck of dust was visible, not a bottle had dirty streaks of its contents coursing down its sides to deposit themselves on the shelf beneath; there was no confusion, and the air was as fresh as it ever can be in London; the usual dirty benches were replaced by clean slabs of plate-glass, whitened beneath, and everything was trim and smart. Yet this was not one of the laboratories of the *dilettanti*; there was plenty of good hard work going on in it; and, with a little management, all laboratories might be equally clean.

Mr. Bloxam has introduced a number of extremely useful tables into his work, to indicate the mode of detecting various elements and compounds; these tables are explained in the text, and constant back-reference is given to them and to individual paragraphs, which latter are distinguished by thick-letter numbers. Not only do we find the modes of detecting the simpler substances, but a large number of organic bodies are also introduced, together with the means of their identification; thus we find picric acid, cholesterine, acetone, naphthaline, aniline, and many other organic bodies described. Altogether, the work is most comprehensive; a great deal could be done with it; a chemist cast upon a desert island with it, and a box of reagents, could examine with ease all the principal products of the place, both mineral and vegetable. To the mining chemist, the work will be of much service; indeed, its usefulness is by no means confined to the student: we venture to assert that the book will be found useful in every laboratory as a work of quick reference and concise direction.

Mr. Bloxam is a thorough conservative; we imagine he is the General Peel of his party—a thoroughly conscientious, sound, true old tory, just a thought obstinate, but with the firmest convictions. It will be remembered that, in his "Chemistry Inorganic and Organic," he has not adopted the new nomenclature or the new equivalents; and we observe here that he has introduced such words as "white vitriol," zinc-white," "Glauber's salt," and "Scheele's green." An air of conservatism pervades the whole work, yet we do not intend to deprecate this, but are rather of opinion that it may help to check the rapidly-advancing tide of chemical radicalism.

MISCELLANEOUS.

Alkaloid Formed during Alcoholic Fermentation.—M. Oser has instituted researches with pure sugar brought into fermentation, and, after a series of operations, has succeeded in obtaining an alkaloid composed according to the following formula:—$C_{10}H_{20}N_4$. The hydrochloric acid combination has the formula—$C_{13}H_{20}N_4HCl$; the combination with chloride of gold is expressed by $C_{13}H_{20}N_4AuCl_4$. The author states that this alkaloid is positively the result of fermentation; but he also intimates that, since older wines contain, according to Ludwig's researches, trimethylamine, it is probable that the alkaloid here alluded to is either decomposed in older wines, or is only met with therein in very minute quantities.—*Polyt. Centr.*

Estimation of the Goodness of Soap.—Prof. Schültze, of Rostock, starting from the view that, the better the soap, the less thereof will be required for the entire unhardening of water, employs the reverse of Clark's process, in the following manner:—He applies a solution of lime in water containing excess of carbonic acid, so that litre of water contains exactly 1·6 grm. of lime. Of this fluid he takes 3 c.c. (containing, accordingly, 4·8 milligrms. of lime), and adds 20 c.c. of water, and a small quantity of soda solution; he further applies an aqueous solution of 5 grms. of soft soap in 100 c.c., or of the same quantity of solid soap in 200 c.c., of water, and adds of these solutions from a burette to the aforesaid lime solution until a lather is fully and completely formed. The smaller the quantity of soap solution required for this purpose, the better, of course, the soap is; and it is easy to calculate how much of the soap solution has been required for one part, by weight, of lime; a perfectly pure soap, however, will be required, for comparison's sake.

Nitroglycerine.—The only safe and proper mode of permitting the use of this substance is, undoubtedly, that adopted in France, Southern Germany, Belgium, and the United States, that is, to allow its use only on the absolute condition that it be made on the very spot where it is wanted, and be only made in quantities sufficient for, at most, three days' sufficient supply. In an article which appeared in the CHEMICAL NEWS, No. 422, vol. xvii., p. 11 (January 3, 1868), on this subject this point was briefly alluded to; and the experience since obtained in the countries above-named, the United States being foremost in this matter, has fully proved the utility of this rule. Nitroglycerine making is readily taught to workmen, and, with some care, succeeds exceedingly well. There is no sound reason why this plan should not be adopted in this country too.

Hygrometer.—Naudet and Co., Paris, Rue et Place Thorigny, 2 and 4, have constructed a portable hygrometer, shaped like a watch. The measuring of degree of moisture is effected by means of a peculiarly-prepared human hair, 0·35 metres long. The mechanism is graduated by placing the instrument under a bell-jar, wherein the air is kept dry by means of recently burnt quick-lime and fused chloride of calcium; and next it is placed under a bell-jar, wherein the air is kept saturated with moisture by means of a wet sponge. The distance between these two extremes, indicated by a properly-constructed mechanism, is divided into 100 parts. The price of this instrument, which is highly spoken of, is 25 francs (£1). It is intended for use in spinning and other establishments, and for observations. —*Deutsche Ind. Zeitung.*

Indelible Ink.—Two solutions are required—No. 1 consisting of—Crystallised chloride of copper, 8·52 parts; chlorate of soda, 10·65 parts; and chloride of ammonium (sal ammoniac), 5·35 parts, to be together dissolved in 60 parts of distilled water. No. 2 solution consisting of 20 parts of hydrochlorate of aniline, to be dissolved in 30 parts of water, to which has to be added 20 parts of a solution of gum (made by dissolving one part, by weight, of gum in two parts of water), and, lastly, 10 parts of glycerine. These solutions are kept in separate bottles. When it is required to write anything with these fluids, one part, by bulk, of solution No. 1 is mixed with four parts, by bulk, of No. 2. The ink must be applied to paper, linen, cotton, wool, or silk, with a quill pen, or small hair brush; at first the writing appears greenish, but it soon becomes black, especially if it is exposed to a higher temperature. This writing is perfectly indelible, and can only be destroyed by destroying the fabric it is placed on.—*Dr. Artus's Vierteljahreschrift.*

Production of Oxygen for Industrial Uses.—The works, in running order, although not yet quite finished, are located at the foot of Forty-first Street, in this (New York) city, a malodorous neighbourhood, where some means, artificial or otherwise, would not be out of place in substituting oxygen for the foul emanations of butchers' shops and dirty gutters. The essential or characteristic portions of the process are carried on by the aid of brick furnaces, of which only one was in operation at the time of our visit, several others being, however, rapidly put up and fitted for use. Each furnace has its fire-box so arranged as not only to heat the retort which holds the manganate of soda (the vehicle through which the process is carried on), but also one or more chambers through which an air-blast passes to the retort. The retort, furthermore, communicates, by a pipe furnished with stop-cocks, with a suitable steam-boiler. The process is carried on as follows:—About 600 pounds of manganate of soda are placed in the retort, heated to the requisite degree in the furnace; superheated steam from the boiler is then admitted for about ten minutes. Two equivalents of the manganate of soda and two of water react upon each other, as indicated by the formula—

$$2(MnO_3,NaO)+2(HO)=2(NaO,HO)+Mn_2O_3+O_3.$$

In other words, the water combines with the soda of the manganate to form a hydrate of soda. The manganic acid is changed to sesquioxide of manganese, containing only half the proportion of oxygen, and the other half of the latter passes off in a free condition. At the conclusion of this part of the process, the steam is shut off, and the superheated air is admitted for about fifteen minutes, whereupon the sesquioxide combines with more oxygen from the air, and is converted back into its original form of manganic acid, which, of course, resumes its former relation to the soda, reconstituting manganate of soda, ready for a repetition of the process. In forcing the air to the apparatus, a steam-pumping engine is used, noticeable for the manner in which friction gearing is applied to transmit power from the engine to the air-forcing pumps, without the jar incident to the use of cogged wheels. The air-blast passes first through cylindrical vessels containing caustic soda, by which its carbonic acid is removed, and thence through the superheating chamber previously mentioned, to the retort. The retort is never opened, as the material shows no signs of deterioration by use. That in the retort at the time of our visit was tested continuously for six months before being brought to this country, and has been in constant use for six weeks past, the period during which the works have been in constant operation. As the oxygen leaves the retort it passes through a suitable meter, which registers the quantity, and thence to the gasometer, which, at the present time, contains 25,000 feet of oxygen gas, much purer than is required for most of the purposes for which it is to be employed.—*American Artisan.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, March, 1869.

This number of this periodical, which is always rather behind-hand as regards its time of being published, does not contain any memoirs or papers which bear upon chemistry, or sciences closely allied thereto.

Annales des Mines, vol. xv., 1st part for 1869.

This periodical contains—

A Biography of the Chemist, P. Berthier.—A concise review of his arduously-accomplished and incessant labours. This lengthy paper is concluded by an enumeration of the titles of the memoirs, papers, and books published by this *savant*, which catalogue occupies no less than fourteen octavo pages, printed in small type.

Although not belonging to the subjects usually treated by us, we cannot refrain from calling attention here to an excellent report on a steam boiler explosion, which took place at Moulins-Lille.

The rest of the papers in this number of this periodical bear upon practical mining, and are not of general importance.

Revue Universelle des Mines, de la Métallurgie, des Travaux Publics des Sciences et des Arts Appliqués a l'Industrie, Nos. 1 and 2 for 1869.

This very useful periodical is published in Belgium, and its editors are Belgians of high scientific as well as practical attainments. The first paper we meet with in this number is an excellent monograph on the—

Mineralogical Character and the Mineral Value of the Iron Ores of the Province of Luijk (Liege).—M. Franquoy.—From among the large number of analyses which accompany this very lengthy paper, we quote the analysis of a couple of samples of *fer-carbonaté lithoide des houilleres*. The first sample contains, in 100 parts:—Carbonate of iron, 73·66; carbonate of lime, 2·98; carbonate of magnesia, 2·06; carbonate of manganese, 3·31; clay, 12·17; water and carbonaceous matter, 5·53; phosphoric acid, 0·29; yield of metallic iron, 34·76 per cent; specific gravity of this sample of ore, 3·15. The other sample contains, in 100 parts:—Carbonate of iron, 56·23; carbonate of lime, 4·84; carbonate of magnesia, 2·93; carbonate of manganese, 0·58; clay, 26·20; water and carbonaceous matter, 9·22; phosphoric acid, a trace; yield of metallic iron, 26·96 per cent; specific gravity of this sample of the mineral, 3·123.

On Saccharimetry.—This paper is a magnificent monograph on this subject, being the result of researches instituted in consequence of the International Convention agreed to by France, the United Kingdom, the Netherlands, and Belgium, on the 8th of November, 1864, in reference to the rules which shall apply to the amount, and mode of payment, of the duties on sugar in these four countries. The paper here alluded to is chiefly the work of Prof. Landolt, of Bonn, and is published by the kind permission of His Excellency the Belgian Minister of Commerce; we regret that it is too full of interesting matter, too concisely written, and, moreover, by far too lengthy for any useful abstraction. As a curiosity rather, and as proving the correctness of the figures adopted by the Netherlands Society of Commerce—whereby raw sugars are designated by the cypher-figures 1, 2, 3, and so on up to 21, according to the degree of purity, and the higher percentage of crystallisable sugar contained in the various samples so designated—we quote the following analysis:—No. 9, in 100 parts—Pure cane sugar, 89·6; organic salts, 4·3; water, 3·8; undetermined substances, 2·3. No. 12, in 100 parts—Pure cane sugar, 93·0; organic salts, 3·7; water, 3·1; undetermined substances, 0·2. No. 15, in 100 parts—Pure cane sugar, 95·0; organic salts, 1·6; water, 2·0; undetermined substances, 1·4. The composition of treacle, in 100 parts, varies between the following limits:—Best sample contained—Cane sugar, 61·8; sucrose (*sucre interverti*), 1·9; salts, 18·9; water, 14·2; undetermined substances, 3·2. Worst sample contained—Cane sugar, 54·4; sucrose, 1·6; salts, 19·9; water, 21·0; undetermined substances, 3·1. All the experiments were made on samples taken from quantities several thousand kilogrammes in weight, and they were performed at Cologne, in the establishment of the Rheinischen Actions Verein für Zuckerfabrikation, one of the largest and best-conducted sugar refineries in the world.

Observations on M. Margueritte's Process of the Volumetrical Estimation of Iron.—M. Léon Moyaux.—This paper ends with the following concisely-stated conclusions, arrived at by the author as result of his experiments:—1st. The normalisation of the permanganate solution can only be properly made by means of metallic iron, and, when the latter metal, in sufficiently pure state for this purpose, does not happen to be at hand, by means of oxalic acid (indirect titration). 2nd. The use of ammonio-sulphate of iron should be rejected; unless, indeed, the precise composition of this salt is repeatedly ascertained, it is not to be relied on, and this testing is a loss of time. 3rd. Repeatedly-continued research is required to ascertain that the solutions of *proto*-salts of iron really keep and continue to be so. 4th. The evaporation of solutions of iron containing hydrochloric or other volatile acids, after the addition of sulphuric acid, always impairs the result of the titration. 5th. The reduction of solutions of *per*-salts of iron to *proto*-salts, after driving off excess of hydrochloric acid, is best effected by means of zinc, better yet by means of amalgamated zinc; but this last metal is to be rejected when a solution of iron happens to contain, at the same time, a proto- and a per-salt. 6th. When 0·3 grm. of ore is taken for assay, in case the ore should contain more than 40 per cent of metallic iron (or, when less than that quantity, 0·5 grm. is taken for assay), the quantity of fluid best suited to yield accurate results should not, in either of these cases, respectively exceed ¼ or ½ a litre.

The other papers of this periodical relate chiefly to mechanical engineering and machinery.

Chemisches Centralblatt, No. 21, May 26, 1869.

The larger part of this paper is occupied with a treatise on the—

Chemical Constitution of the Organic Hydrocarbons.—M. Kolbe.—The author of this lengthy treatise begins by stating that, however ingenious M. Kékulé's theory may be, that theory is, after all, a failure, and in every respect erroneous. The author next states that, according to his opinion, a solid basis for speculation, on the true constitution of the organic hydrocarbons, is to be deducted from our experience with organic ammonias. The comparison of these two kinds of compounds has made clearly understood to him the nature of di- and tri-carbon acids, in reference to mono-carbon acids; and the organic ammonias, wherein nitrogen and phosphorus equivalently act, are the counterpart and example for the mode of constitution of the carbo-sulpho-acids. Ammonia, H_3N, and marsh gas, H_4C, are, in this sense, comparable, and may be placed side by side, just as, from ammonia, by substitution of the hydrogen atoms for the alcoholic radicals, organic ammonias are produced, which possess basic properties, so, from marsh gas, *carboles* are formed. Ammonia, therefore, agrees (*entspricht*) with the carbol, H_4C; the methylamine, the methyl-carbol, and di- and tri-methylamine agree with the di- and tri-methyl-carbol.

Ammonia.	Methylamine.	Dimethylamine.	Trimethylamine.
$\left.\begin{matrix}H\\H\\H\end{matrix}\right\}N$	$\left.\begin{matrix}CH_3\\H\\H\end{matrix}\right\}N$	$\left.\begin{matrix}CH_3\\CH_3\\H\end{matrix}\right\}N$	$\left.\begin{matrix}CH_3\\CH_3\\CH_3\end{matrix}\right\}N$
Carbol.	Methylcarbol.	Dimethylcarbol.	Trimethylcarbol.
$\left.\begin{matrix}H\\H\\H\\H\end{matrix}\right\}C$	$\left.\begin{matrix}CH_3\\H\\H\\H\end{matrix}\right\}C$	$\left.\begin{matrix}CH_3\\CH_3\\H\\H\end{matrix}\right\}C$	$\left.\begin{matrix}CH_3\\CH_3\\CH_3\\H\end{matrix}\right\}C$

The learned author proceeds, in this manner, with his essay, proving, by a great variety of instances, the truth of his statement; his paper is, however, not well suited for abstraction, and the less so from the fact that, in the above-named periodical, a condensed abstract only is published.

Reduction of Carbonic Acid to Oxalic Acid.—M. E. Drechsel.—Pure and clean sodium, exhibiting a metallic surface, is placed, along with some freshly-ignited quartz-sand, into a clean flask, and a rapid stream of carbonic acid gas is passed into the flask, which, at the same time, should be heated to the temperature of boiling mercury, 662° F. The sodium molten at this temperature yields, on being stirred up with a glass rod, a silvery semi-fluid paste. As soon as the reaction sets in, the metal assumes a purple colour, and, after a few hours, is converted into a dark pulverulent mass. Too much heat should not be applied; and, especially towards the end of the operation, great care is required in managing it, since a too high degree of temperature may cause the combustion of the newly-formed product. After having cooled in the flask, the substances therein contained are withdrawn from it, and, having been spread out in a thin layer, so as to effect the oxidation of any small particle of sodium not yet acted upon, the mass is exhausted with water, the aqueous solution saturated with an excess of acetic acid, and, after having been filtered, precipitated with chloride of calcium; the precipitate thus formed is almost always rather brownish coloured. It is dissolved in hydrochloric acid, filtered while yet hot, and precipitated with ammonia, whereby the salt, oxalate of lime, is obtained perfectly snow-white; 60 grms. of sodium yield, by this process, 6 grms. of pure oxalate of lime. Instead of sodium, a potassium-amalgam, containing 2 per cent of the alkali metal, and otherwise treated in the manner just described, yields a fair percentage of oxalate of potassa.

Nos. 22 and 23, June 2 and 9, 1869.

These two numbers do not contain any original memoirs, papers, or communications.

Bulletin de l'Academie Royale des Sciences, des Lettres et des Beaux Arts de Belgique, No. 4, 1869.

The only treatise contained in this number relating to chemistry is the first portion of an essay on the—

Isomerism of the Salicylic Series.—M. L. Henry.—The first section is headed—*Chlorinated Derivatives from Salicylic Aldehyde.* The derivatives of the *mono-substitués* of toluen and benzoic acid are pretty well known, and ought, according to this author, to be separated into three distinct groups, designated respectively—*ortho*, *para*, and *meta* series, each of these embracing a peculiarly characteristic mono-chlorinated benzoic acid, $C_7H_5ClO_2$, and a diatomic acid, $C_7H_6O_3$. The author also proposes to name each of the three groups already alluded to—the *benzoic*, or *oxybenzoic*; the *dracylic*, or *paraoxybenzoic*; and the *salylic*, or *salicylic* series. Of each of these series, a large number of very complex formulæ are given, but the paper, however interesting in a purely scientific point of view, is, on account of its length, and on account of the large space which the quotation of the formulæ would require, not quite suitable for further abstraction.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 9, May 23, 1869.

We notice the following original papers from this periodical:—

Contribution to our Knowledge of the Doubly-Coupled (Gepaarte) Compounds of Inorganic Chemistry.—M. C. W. Blomstrand.—In the introduction to this paper, the author refers to a published work of his, to which the title "Die Chemie der Jetztzeit" (the chemistry of the present day) is given. Next, he states that, when explaining and settling the question about coupling, he mentioned some experiments of his on the behaviour of iodine towards yellow prussiate of potassa, which were not quite successful. The author next proceeds to review the ammonia compounds of platinum, and says that he considers the so-called platino-cyanide of chloride of potassium, $2KCl + PtCy_4$, to be the perfect analogue of Grosses's base, which manner of viewing may be made evident by giving to the respective formulæ of these substances the following form:—Grosses's base—

$$(Cl—NH_3—NH_3)_2Pt_4Cl_4;$$

platino-cyanide of chloride of potassium—

$$(K—Cy—Cy)_2Pt_4Cl_2.$$

The author next proceeds to describe a lengthy series of researches on this subject, but his paper, an abstract of an abstract and *vivâ voce* communication by Dr. H. L. Buff, at the meeting of the Society, is too full of formulæ to be suitable for further abstraction.

On Binitro-Cresol.—MM. Martius and Wichelhaus.—There is met with in commerce, under the name of Victoria yellow, or aniline orange, a reddish powder, which yields highly yellow-coloured solutions, and bears, in general, great likeness to the binitro-naphthol compounds. The authors have instituted some researches on this material, and have made found it to be a nearly pure binitro-cresol salt. The binitro-cresol they separated from it is readily soluble in alcohol, ether, chloroform, and boiling water; it may be obtained in crystalline shape; the dry substance fuses at about 110° C.; the silver-salt is rather difficultly soluble, and may be obtained in crystals. The authors have tried in vain to obtain, by the experimental method, a clue to the mode of manufacture and origin of this material. The solutions of binitro-cresol become gradually deep-red coloured on exposure to air, and also when chloride of iron is added to the same.

Some Derivatives from Phenylacetic Acid (α Toluylic Acid. M. B. Radziszewski.—The author first describes the method whereby he prepared this acid; we need not repeat this, as the author says it is well known, and is that used by Cannizzaro. The methyl ether of this acid is a colourless liquid of 1·044 sp. gr. at 16°; it boils at 220°, without decomposition. The ethyl ether of the above-named acid is a liquid, having a sp. gr. of 1·031; it boils at 226°. The author next proceeds to describe the action of bromine upon the α toluylic acid; then the action of bichromate of potassa and dilute sulphuric acid; next, the action of chlorine, of nitric acid, and other chemicals; and winds up with saying—"The result of my researches is, that the α toluyl acid behaves with the haloids, and with nitric acid, as does toluol, giving rise, chiefly, to the formation of para products."

On the Pyromucic Acid Group.—M. Limpricht.—This paper could not be understood without the reproduction of the woodcut annexed to it.

Action of Sulphuric Acid upon Polychlorated Hydrocarbons.—M. A. Oppenheim.—When ethylen-chloride is acted upon by sulphuric acid, at the ordinary temperature of the air, and at 100°, in sealed tubes, no action whatever ensues; at 130°, however, decomposition takes place, carbon is separated, sulphurous acid formed, and, hydrochloric acid generated. When chlorobenzol, $C_6H_5.CHCl_2$, is mixed, at the ordinary temperature, with sulphuric acid, hydrochloric acid is given off without causing a colouration of the liquid; but, at 100°, complete decomposition sets in, and carbonaceous matter is deposited. A syrupy product of this decomposition may be obtained, exhibiting a fluid having a constant boiling point at 175°; its smell is akin to that of the essential oil of bitter almonds.

Constitution of Epichlorhydrin.—M. L. Darmstädter.—The author states that, according to his opinion, the formula of epichlorhydrin has to be written—

$$O\begin{matrix}CH_2Cl\\CH\\CH_2\end{matrix}.$$

Next, he mentions some experiments, in order to prove that the oxygen of epichlorhydrin is combined, by double affinity, to carbon, and is not present therein as hydroxyl. To prove this, he states, at length, what action bromine and chloride of phosphorus exert upon substances containing hydroxyl; and then he gives an account of the action of these two chemicals upon epichlorhydrin. One of the results of this reaction is a liquid, which, in 100 parts, contains:—C, 15·22; H, 2·11; Cl, 15·01; Br, 97·65.

Constitution of the Native Combinations of Tantalum and Niobium.—M. C. Rammelsberg.—This paper is more of mineralogical than chemical interest; and, being an abstract from a large essay on this subject is not well suited for further condensation.

On Dinitronaphthalin.—M. A. de Aguiar.—The author states that, when dinitronaphthalin is prepared from naphthalin, an isomer thereof is formed at the same time, which, being readily soluble in alcohol, may by that means be separated from the non-soluble variety. The variety soluble in alcohol the author calls β dinitronaphthalin; it is a crystalline solid substance, containing, in 100 parts:—C, 55·04; H, 2·75; formula, $C_{10}H_6(NO_2)_2$. The solutions of this substance become red on exposure to the atmosphere, and also on being treated with ammonia; treated with nitric acid, trinitronaphthalin is formed.

Annalen der Physik und Chemie, von Poggendorff, No. 4, June 1, 1869.

This periodical contains, as usual, a large number of original essays, for, in reality, the labours of the authors are rather essays than papers. The first we meet with is—

A Contribution to our Knowledge about Thunderstorms.—M. W. Bezold.—Although this is a meteorological subject, we call attention to this paper, in compiling which the author has made use of the records of insurance companies in Bavaria and Austria, and also of some local statistics collected in the towns and districts, and has applied these materials for the purpose of making a valuable essay on a subject which, as he rightly remarks, cannot be so well elucidated by the observations made at the meteorological observatories, these being too few in number and too far distant from each other. Between the years 1844 and 1865, no less than 1242 buildings, among the large number of those insured against accidents by fire, in Bavaria, were struck by lightning; this is in the proportion of forty-four buildings struck by lightning each year, upon 1,000,000 of buildings insured. The essay, from which we cannot abstract more, on account of its subject matter being foreign to the subjects treated of in our paper, deserves the attention of those whom it may concern in many aspects.

On Leucitstone, as it occurs in a Peculiar Ore-Bearing Rock.—M. F. Zirkel.—This communication is a purely mineralogical essay, the subject of which is, beside, of local importance, only referring, as it does, to a single locality.

Certain Phenomenon of Refraction of Light first Observed by Quincke, and Changes of the Rays of Light during Total and Metallic Reflection.—M. E. Jochmann.—This, being an entirely mathematico-physical essay, is not suitable for abstraction.

Meteorites Deposited and Kept in Museums.—Dr. Buchner.—This is the fourth and concluding portion of a lengthy essay on this subject, compiled, in great measure, from previously-published papers dispersed through a series of periodicals.

A Hitherto-Unobserved Electric Powder Figure.—M. Kundt.—The author, referring to the well-known Lichtenberg figures, caused by electricity when very finely-powdered substances, such as Lycopodium, are applied to an isolator, states that he has discovered a new kind of these figures, formed on a conducting surface, and less dependent than the Lichtenberg figures upon the peculiar kind of electric developer to be used. The author describes, at length, the various means by which he obtained these figures.

Determination of the Specific Heat of a Constant Bulk of Air by means of the Metallic Barometer.—M. Kohlrausch.—A mathematico-physical essay.

Trigonal Pyramid ξ on the Quartz from Baveno.—Dr. Becker.—A mathematico-crystallographic essay.

Composition of Hydrofluocerite.—M. Nordenskjold.—The author says this mineral, which contains fluoride and cerium, was discovered in the year 1838, at the Bastnäs quarry, near Riddarhyttan, Sweden, and then analysed by M. Hisinger. The author further states that, when he resumed the researches of this mineral, he found that its earlier investigators had made a mistake as to its containing water, of which it contains a mere trace; and, next, he records the mode of his researches of the mineral now named by him *hamartite*, from the Greek ἁμαρτω, to err. The result of his analysis is, that this mineral contains, in 100 parts:—Oxide of lanthanum, 45·77; oxide of cerium, 28·49; carbonic acid, 19·50; water, 1·01; fluorine, 5·23. Formula, $CeF_3 + 2(LaO,CeO)CO_2$.

Grain Test for Bin-Axial Mica.—M. E. Rensch.—A crystallographical essay.

Discovery of Large Crystals of Quartz in a Very Difficultly-Accessible Portion of the Swiss Alps.—This paper is a reproduction from a newspaper published at Berne, and describes the cavern wherein these crystals were found; one of these weighs 267 lbs., is 69 centimetres in height, and has a circumference of 122 centimetres. This may suffice for this subject.

The editor of the *Annalen* very properly calls attention to a most useful work, now in regular course of publication under the auspices of the Prussian government—viz., the *Repertorium der Technischen, Mathematischen und Naturwissenschaftlichen Journal-Literatur*. This most useful work, to which we may add the index of foreign scientific periodicals, will, as justly observed by the editor of *Poggendorff's Annalen*, keep the place of a permanent and periodically-pub-

lished supplement to the Royal Society. The of some 150 periodicals whole world. It may be inspected at the Library of the Commissioners of Patents, where it is regularly taken in.

talogue of scientific papers published by ertorium records the titles of the papers all languages, and published over the

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Annalen der Chemie und Pharmacie, June, 1869.

Contents :—

Action of Boiling Liquids containing Acids and Alkalies upon Glass and Porcelain Vessels.—Dr. A. Emmerling.—This essay, or rather monograph, contains the record of a series of most minutely-executed experiments, whereby to determine the influence of various fluids, containing acids, salts, and alkalies, upon vessels made of different qualities of glass and porcelain, in order to determine the amount of substance dissolved by such chemicals, and also by pure distilled water, and to ascertain what influence is thus exercised upon the accuracy of analysis and chemical researches in general. This monograph is full of interesting details, including analyses of glass. *En résumé*, its leading features are the following :—The action of boiling liquids, as specified above, upon glass vessels is proportionate to the duration of time of boiling; the action is proportionate to the surface which is in contact with the boiling fluid; the action is independent of the quantity of fluid which evaporates during a given time; the action decreases with the decrease of temperature of the solution; alkalies, even in dilute solutions, attack glass very strongly; acids generally act less than pure water, excepting sulphuric acid; among the salts, those act most energetically whose acids produce insoluble salts with lime—*e.g.*, sulphate and phosphate of soda, carbonate of soda, and oxalate of ammonia, the action of each of which increases with the degree of concentration of the solution; such salts as form, in water, readily-soluble lime-salts—for instance, the chlorides of ammonium, potassium, calcium, and nitrate of potassa —less strongly than pure water alone, and, with the greater degree of concentration of these salts, the action decreases. Bohemian glass stands acids better than the kinds of glass containing soda; the Berlin porcelain ware is only perceptibly acted upon by alkalies.

Researches on the Isomers of the Benzoic Series (ninth monograph, containing "The Chlorinated Derivatives of Toluol").—MM. Beilstein and Kuhlberg.—This essay is too lengthy for abstraction; the subject, moreover, has been already abstracted from another German publication.

On Oxylohydroxamic Acid.—Dr. H. Lossen.—This acid is a solid substance, difficultly soluble in cold water; submitted to a higher temperature it is slowly decomposed; when suddenly heated to 105°, it detonates; boiling for a length of time with water does not decompose it; on being boiled with caustic potassa solution it is converted into oxalic acid: nitric acid decomposes it completely and very rapidly. This acid consists, in 100 parts, of:—C, 20·00; H, 3·33; N, 23·33; O, 53·34. Formula, $C_2H_4N_2O_4$. The author describes, at great length, a series of salts of the oxylohydroxamic acid.

Researches on Mesitylen (sixth series).—Some Newly-Discovered Derivatives of Mesitylen.—MM. Fittig and Hoogewerf. —This essay has been noticed by us already, since an abbreviated account of the subject herein refered to was published in another German periodical published previous to this number of the *Annalen*, and noticed by us.

Chemical Constitution of Glycerine and its Derivatives.—M. Kolbe.—The learned author of this monograph starts from the hypothesis that glycerine should be equal to—

$$\left.\begin{matrix}CH_2\\CH_2.HO\\HO\\HO\end{matrix}\right\}C;$$

and next states that glycerine contains the elements of two groups of methyl, constituted in the following manner :—

$$\left.\begin{matrix}CH_2.HO\\CH_2.HO\\H\\HO\end{matrix}\right\}C, \quad \text{and} \quad \left.\begin{matrix}CH.(HO)_2\\CH_3\\H\\HO\end{matrix}\right\}C.$$

The author then reviews such a lengthy series of compounds, and takes such extensive excursions over the immense field of organic chemistry, that it is impossible to compress into a small space even a minute fraction of this monograph, to which, therefore, we will not allude any further, especially as it is more a philosophico-chemical dissertation on an abstruse subject than of direct practical application.

Journal für Praktische Chemie, No. 7, June 15, 1869.

The following original papers are found in this periodical :—

On Sanguinarin, its Properties and Composition.—M. Naschold.—Sanguinarin is so named because it is prepared from the *Sanguinaria canadensis*, but it also occurs in the *Chelidonium majus*, and *Glauceum luteum* : it is an alkaloid which, in pure state, is a crystalline, white-coloured solid; formula, $C_{17}H_{12}NO_4$. As a peculiarity, the author observes that the estimation of the nitrogen contained in this substance cannot be satisfactorily executed with the well-known soda-lime process, but has to be performed by Dumas's method. The author describes, at length, several combinations of sanguinarin with the chlorides and cyanides of platinum, its behaviour towards reagents, and its products of decomposition, but none of these are so precisely characteristic as thereby to render it easy to distinguish and detect sanguinarin from all other alkaloids.

Brandy obtained from Reindeer Moss.—M. Stenberg.—This paper contains, translated from a pamphlet published in Swedish, a more extensive account of a subject to which, some time since, we referred in our columns, and, since it is of no importance, except where the *Cladonia rangifera* is found, we make no further abstract of this paper.

Estimation of Sulphur.—Dr. G. J. Mulder.—The author speaks of the estimation of sulphur in such substances which contain carbon and sulphur together, and are not very volatile, and are, at the same time, free from any ash or incombustible matter. A certain quantity of the substance wherein the sulphur has to be estimated is weighed off in a porcelain capsule; there is next added a weighed quantity of finely-powdered nitrate, or acetate of lead; next, some nitric acid, the strength of which depends upon the nature of the substance to be assayed; and, lastly, a few crystals of pure nitrate of ammonia are added. The contents of the porcelain vessel are now carefully evaporated to dryness, ignited, and weighed. Since the weight of the oxide of lead derived from the acetate or nitrate employed is known, the increase of weight of the capsule and contents is due to the sulphate of lead which has been formed from the sulphur originally contained in the substance submitted to experiment. This method also yields accurate results when, besides sulphur, there may be iodine and bromine present, and also lead; the method may be used, also, for the estimation of phosphorus, when, in substances containing both that element and carbon, it is desired to estimate the former quantitatively, provided, of course, sulphur be absent.

Products of Decomposition of Legumin when Boiled with Dilute Sulphuric Acid.—M. Ritthausen.—The author states that, while he was engaged studying the products of decomposition of legumin and conglutin, he discovered a nitrogenous acid, which contained, in 100 parts :—C, 39·46; H, 6·14; N, 12·04; O, 42·36. This acid was called, by the author, leguminic acid. On resuming his investigations on this subject, he finds, as explained in this paper, that the acid just alluded to is a mixture of two amine acids—to wit, asparaginic acid, $C_4H_7NO_4$, and glutaminic acid, $C_5H_9NO_4$; both these acids are homologous—both are solid crystallisable substances, yielding, among their products of decomposition, by the action of nitric acid, malic and glutanic acids.

Gewerbsblätter fur das Königreich Würtemberg, Nos. 5 and 6, 1869.

This periodical rarely contains anything but matters relating to applied mechanics and agriculture; in this number, however, we meet with a paper—

On Cyanine.—M. Morat.—The author says that the colouring matter of flowers consists—1st, of cyanine, or a blue pigment; 2nd, a rose, or pink-coloured matter, in reality identical with the first, and only altered by an acidity of the juice; 3rd, two yellow-coloured matters—xanthine, insoluble in water, and xanthéine, soluble in that liquid. Cyanine is best prepared from the petals of violets or iris flowers; by exhausting these with boiling alcohol, a blue solution is obtained, which solution, however, soon turns brown, but is restored to its primitive colour by being shaken up in contact with air. In order to obtain the colouring matter in a pure state, the alcoholic solution is evaporated to dryness on a water-bath, and the residue taken up with water, wherein the blue pigment is soluble, while fatty matter and resins are left behind; the aqueous solution is precipitated by acetate of lead; the ensuing green-coloured precipitate is decomposed by sulphuretted hydrogen, filtered, and washed, and the filtrate next evaporated to dryness upon a water-bath; the residue is exhausted with absolute alcohol, and the cyanine precipitate from its solution therein by ether. Cyanine does not crystallise, is soluble in water and alcohol, and insoluble in ether; acids turn it red, and alkalies green —it is a very highly sensitive reagent for both. Reducing agents decolourise cyanine; oxygen restores the colour. The red colouring matter of flowers is extracted in a similar manner, and, once isolated, exhibits characters identical with cyanine.

On Oenoline.—M. Morat.—Oenoline is the colouring matter met with in genuine red wines obtained from grapes; it is obtainable by treating the wine with basic acetate of lead; the ensuing precipitate is collected on a filter, washed, dried at 100°, and placed in a displacing apparatus, and while therein there is poured over the dry precipitate anhydrous ether, previously saturated with dry hydrochloric acid gas. There runs off a brown-coloured liquid; the precipitate is washed with anhydrous ether until what runs off ceases to have an acid reaction. The residue in the displacing apparatus, which now exhibits a bright red colour, is treated with alcohol of 36° Beaumé, which thereby assumes the same bright red colour. The alcoholic solution is concentrated, by evaporation, to a small bulk, and water is next added; this causes the colouring matter to precipitate as a red-coloured flocculent substance, insoluble in ether, very difficultly soluble in water, soluble in alcohol, and insoluble in benzol. By a long-continued boiling in water, this colouring matter is changed, becomes brown, and loses its solubility in alcohol. The solution of the unaltered red pigment in dilute alcohol exhibits the following reactions :— Chlorine water and chlorine gas destroy the colour, producing thereby a yellow substance soluble in water; caustic potassa causes, first a blue, and next a brown colouration; lime-water yields a yellowish precipitate; bicarbonate of soda in aqueous solution, and aqueous solution of chloride of calcium, cause a blue colouration; solution of alum causes a brighter red colouration; hydrochloric acid effects no change; with nitric acid, a yellowish flocculent matter is thrown down; acetate of lead causes a blue precipitate; nitrate of lead produces a violetish red precipitate; acetate of copper yields a chestnut-brown coloured precipitate. This red colouring matter is composed according to the following formula :—$C_{10}H_{10}O_5$. Young red wine contain, moreover, a pigment, soluble in acetic and butyric eth

with a bluish violet colour, becoming green by ammonia, and finally turning brown. Some chemists consider that this material is identical with cyanine; it is not a very stable compound, and is only met with in young wines. The colouring matter of wine is of some interest, as affording a means for detecting adulterations and artificial substitutes of wine.

Polytechnisches Journal von Dingler, second number for May, 1869.

Among the original papers, other than those relating to mechanical art and purely practical engineering, we meet here with a lengthy essay on the—

Conditions which are required for the Formation of Hypochlorite of Lime.—MM. Tschigianjanz, Fricke, and Reimer.—The authors, who have most thoroughly investigated this subject, begin their essay with the statement that, in practice, as well as in theory, a real influence has been ascribed to the moisture and state of hydration of the slacked lime which is submitted to the action of the chlorine gas; next, they review the opinions and labours on this subject of MM. Weisz, Morin, and Houton-Labillardière, Dr. Ure, Dr. Muspratt, Prof. T. Graham, and, lastly, Dr. Bolley. Curiously enough, the opinions of these learned gentlemen vary, and even to such an extreme that, whereas some of them assert that dry hydrate of lime (slacked lime) is capable of taking up 40, or even 50 per cent of chlorine gas, some of them declare that hydrate of lime, dried at 100°, does not take up any chlorine gas at all. The authors of this essay, fully convinced that men of eminently high standing in scientific matters, and especially Prof. T. Graham, were not likely to err in their observations, were led by an observation, made by the last-named *savant*, that lime dried over sulphuric acid in the vacuum made by an air-pump behaved differently towards chlorine gas from that dried at 100°. To investigate this subject fully, the authors of this essay commenced by procuring good pure caustic lime, a matter of far more difficulty than one would imagine at first. They succeeded in obtaining this material by taking the caustic quick-lime of commerce, made from pure mountain limestone, soaking that material with oil, and burning or igniting it a second time, after having placed it in a crucible heated in a furnace with coke and charcoal, and a strong blast produced by a pair of blacksmith's bellows. Quick-lime, thus prepared, when placed in water, is instantaneously converted into hydrate of lime, while there is produced, at the moment of contact of the quick-lime and water, a hissing noise, as if of a piece of red-hot iron quenched with water. The authors also prepared a quick-lime from pure white marble, soluble in very dilute hydrochloric acid, without residue; they took care that, whenever they dried the hydrate of lime intended for their experiments, to exclude the access of carbonic acid gas from that hydrate. They next repeated Prof. T. Graham's experiment, working comparatively drying weighed quantities of slacked lime over sulphuric acid, as well as by means of heat, passed chlorine over these quantities for 1½ hours, and expelled excess of that gas, left uncombined by means of a current of dry air free from carbonic acid. The results of their extensive labours are:—1st. Slacked lime, retaining even as small a quantity as 0·4 per cent of water (as is the case with that dried over sulphuric acid *in vacuo*), and any larger quantity of water retained is sufficient to effect the formation of hypochlorite of lime at any temperature. 2nd. Hydrate of lime, dried at 100°, or even at 130°, is converted into hypochlorite of lime, even at 0° (32° F.), provided the lime is freely allowed to become heated by the absorption of chlorine gas; but, if by means of keeping the temperature at 0°, or even lower, the lime is prevented becoming heated, no action at all, or only a very slight one, took place. The authors call attention to the often-overlooked fact that it is very difficult to obtain a chlorine gas quite free from hydrochloric acid gas, against which they have taken peculiar precautions in the course of the experiments just alluded to.

Behaviour of Chlorine, Iodine, and Bromine towards a Solution of Permanganate of Potassa.—M. W. Lindner.—The author says, when, to any solution containing a compound of iodine, a drop of a dilute solution of permanganate of potassa is added, the peculiarly characteristic colour of the latter substance is changed into brown—that is to say, that iodine is set free and the permanganate reduced. It does not matter whether the original solution of the iodide has an acid or an alkaline reaction, for, in the former case, the fluid will be clear and transparent, in the latter turbid. A neutral solution of a bromide is not affected by the permanganate, neither is an alkaline solution; but if the solution of the bromide is acidified with nitric acid, the reaction, on addition of the permanganate, takes place in the same manner as for the iodide solution. A solution of a chloride is never, under any conditions, acted upon by the permanganate. The author states that, even when solutions of iodides or bromides are so dilute as hardly to be detected by nitrate of silver, the permanganate never fails to detect the presence of them, but does not, at the same time, distinguish between iodine and bromine, for which purpose the specially-distinguishing reagents for these two halogens have to be applied.

Les Mondes, July 8, 1869.

We find in this paper the following original communications:—

Agronomical Map of France.—M. Delesse has received, from every canton the empire is subdivided into, two average samples of the arable soil of each of these small districts, taken at a depth of 15 centimetres below the surface. The author has thus in hand 6000 samples, and proposes, after chemically and mineralogically testing and classifying them, to employ the information thus obtained in constructing an agronomical map o[illegible] upon the nature of the soils of the divers localities wil[illegible] indicated.

Electrical Phosphoroscope.—[illegible] This instrument is based upon the same principle as that [illegible] Becquerel; its essential parts are a Ruhmkorff induction ap[illegible] sparks of which throws light on the phosphorescent objec[illegible] a [illegible] frame, one of the ends of which hides the object [illegible] moment it is illuminated by the electric spark. This [illegible] 40 centimetres in length by 10 centimetres in breadth [illegible] its centre on an axis, which may be made to move r[illegible] of a pedal. The arrangement of this apparatus, whi[illegible] lucidly described in the original, and could not be we[illegible] out a diagram, is such as to render it serviceable f[illegible] phosphorescence excited by a blow, as well as by fri[illegible] omena of phosphorescence of substances which, [illegible] nium, is only of very short duration, can be obser[illegible] this instrument equally well as the long-continue[illegible] sphorescence induced by friction in pieces of porc[illegible]

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 197, May, 1869.

The greater part of this periodical is devoted to mechanical science. The only paper of interest to chemists is a lengthy report on the—

Manufacture and Use of Animal Phosphated Chlorinated Manure.—Dr. Boucherie.—All farmers know that now and then it happens that horses, cattle, or sheep die; and it is chiefly the disposal of their carcases which the report here alluded to treats of. The skin is taken off, and, after having been disinfected, is sold; the intestines are mixed with quick-lime, and buried in a spot to be always kept for such a purpose; the remainder of the carcase is cut into pieces weighing from 5 to 6 kilos., and placed in a wooden tank lined inside with lead, and of about 120 cubic feet capacity. Water is added to the remains of the dead beast, bones included, and about 400 kilos. of crude commercial hydrochloric acid; ebullition is effected by means of the introduction of steam, obtained from the portable steam boiler; after boiling for about six hours, the entire mass is disintegrated. In order to destroy the very unpleasant smell resulting from this ebullition, some lumps of peroxide of manganese are added, whereby a slow but constant disengagement of chlorine gas, is obtained, and all disagreeable smell avoided. When the liquid and contents of the tank are thoroughly cold, the solidified fat which floats on the top is taken away, and fit for the soap or candle maker; the clear liquid is run off and mixed with 200 kilos. of coprolite powder, or bone-ash, and thus converted into a useful manure. At the bottom of the tank will be found a brownish-coloured pulpy mass, which has lost all traces of organised structure, and this material, after having been mixed with some mineral phosphate, is also applied as manure. The following is the composition, in 100 parts, of the liquid manure here alluded to, previous to its being mixed with mineral phosphate:—Water, 79·60; organic matter (containing 1·28 per cent of nitrogen), 10·65; ash (containing 2·38 per cent of phosphoric acid), 9·45. The brownish pulpy mass contains, in 100 parts:—Water, 16·75; organic matter (containing 3·90 per cent of nitrogen), 31·17; ash (containing 8·20 per cent of phosphoric acid), 52·08. The quantity of materials obtained at each operation is stated to amount to about 70 kilos. of fat, 1500 litres of liquid, and 700 kilos. of brownish pulpy animal matter; these quantities, however, will vary according to the size, weight, and nature of the animals so disposed of. This process is recommended above the burial of dead animals; and in some communes of France, it is already ordered to be adopted in all cases, since it is a useful addition to the sanitary regulations of the country.

NOTES AND QUERIES.

Powdering Isinglass.—Isinglass, owing to its toughness, is a substance which it is almost impossible to reduce to powder by means of pestle and mortar; but, akin to horn, to cork, and such-like substances, it may be obtained in pulverulent shape by means of a sharp, well-hardened, but not too coarse file. Lump isinglass answers best for this purpose.

Pattinson's Method for Extracting Magnesia from Limestone Rocks.—Would any correspondent obligingly give me the process of extracting magnesia from the limestone rocks containing that earth, by Pattinson's method; it appears to be accomplished by carbonic acid.—W. R.

TO CORRESPONDENTS.

Communications have been received from Dr. Wood; Mawson and Swan; W. H. Preece (with enclosure); C. Martin; Dr. F. C. Calvert, F.R.S.; F.E.S.J.; J. S. Parker; W. Hawkesworth; W. Sim (with enclosure); Smith and Son (with enclosure); Dr. E. Schunck, F.R.S.; Ritchie and Sons; Dr. S. Muspratt; C. Bailey; W. N. Hartley; G. G. Walmsley; J. Fordied; H. Mayne; G. Clarke; J. Winter Jones; S. E. Phillips (with enclosure); G. F. Rodwell; J. Wilkinson and Co.; and L. F. Haseler, Queensland, Brisbane.

THE CHEMICAL NEWS.

VOL. XX. No. 505.

ON SOME GENERIC REACTIONS IN ORGANIC CHEMISTRY.

By S. E. PHILLIPS.

ORGANIC chemistry has been variously defined: I would represent it as essentially "the chemistry of generic reactions."

It is mooted that a fuller recognition, and a more systematic study of a few widely-generic reactions, may do much to bring about a more simple outline classification of the vast wonders of organic combinations.

These reactions have been recognised in their simplest expressions; but it has not been so clearly shown that they extend into regions of great intricacy, where the guidance of law is so much needed in the discrimination of complex types of combination.

Astronomy and geology have aspects of immensity which engage and entrance the noblest powers of human intellect, nor is chemistry in any way inferior as another receding horizon of infinity.

These aspects are, indeed, the inverse of dissolving views, for it is the reward of genius, of labour, and sacrifice, to decipher, out of the dim chaos, minarets and pinnacles of architectural beauty, which entrance the mind and afford a pleasure that never satiates: and every line traced adds a new lustre, and a richer meaning, to those already drawn.

Moral and physical truth have a distinction only in a human or circumferential sense. All aspects of divinity coalesce and commingle towards an effulgent centre of infinite harmony; hence poets have been co-labourers with our profoundest philosophers and physicists in promoting the conviction that—

> "Discord is harmony ill-understood;
> All partial evil, universal good."

In offering these thoughts as an amateur, in presence of men whose abilities and means of investigation are greatly superior, some apology or explanation may be desirable.

The sincere desire is to write in a humble spirit of enquiry, rather than of dictation.

It is true that most English chemists have adopted the new notations; but, seeing that in the continental journals fully one-half the articles are written in old style, and that so great an authority as Dumas does not hesitate to express entire inability to read modern chemical memoirs, owing to their complex types and "barbarous" nomenclature, surely it may be forgiven in an unpretending student to express long-pent-up thoughts in what appears to him as the clearest and simplest language, the more so as his object is purely to ventilate principles (which are independent of modes of representation), and also to challenge students of the modern ways, to see if they can penetrate deeper or see further into the wonderful labyrinth.

The pretentious methods of modern notation are certainly curious in their way; and it is refreshing to see the tone of sober-minded reaction which has been evinced at the recent discussions of the Chemical Society.

One of the most prominent facts of general chemistry is that hydrides are "indifferent bodies"—they do not combine without decomposition—yet Professors Hofmann and Wanklyn see in these prolific sources of substitution, and even of direct dedoublement; they are prominent in the diamines and triamines of the former, and to the latter they are leading types to which other definite chemical combining bodies may be referred:—

Ethylene. $C_4\begin{cases}H\\H\\H\\H\end{cases}$ Hydride of ethyl. $C_4\begin{cases}H\\H\\H\\H\\H\\H\end{cases}$

Rosaniline. $C_4\begin{cases}NHC_{12}H_5\\NHC_{12}H_5\\NHC_{12}H_5\\H\end{cases}$ Leucaniline. $C_4\begin{cases}NHC_{12}H_5\\NHC_{12}H_5\\NHC_{12}H_5\\H\\H\\H\end{cases}$

M. L. Henry holds that salicylic alcohol is an *aldehyde* as well as a *phenol*, and that by chloro-variation it gives the following series:—

Salicylic alcohol, $C_6H_4<^{HO}_{CHO}$

Doubly-chloruretted cresol, $C_6H_4<^{HO}_{CHCl_2}$

Triply-chloruretted toluol, $C_6H_4<^{Cl}_{CHCl_2}$

Chloruretted aldehyde of salicyl, $C_6H_4<^{Cl}_{CHO}$

Whether the first really be an alcohol, or the last an aldehyde, is by no means certain, or even apparent, so random are these type-building speculations. And it seems strangely overlooked that the old radical theory is, peradventure, adequate to explain all these substitutions without any such paradoxical nomenclature.

The first pair, as *hydrides*, would be—

$(C_{14}H_5O_4),H$ and $(C_{14}H_5O_2),H$;

the second pair are evidently chlorides—

$(C_{14}H_5Cl_2),Cl$ and $(C_{14}H_5Cl_2O_2),Cl$;

as *alcohols*, the first pair would be—

$(C_{14}H_5O_2)O+HO$ and $(C_{14}H_5Cl_2)O+HO$

Another authority, speaking of an acid derivative of mesitylen, $C_{18}H_{11}H$, says $C_9H_6O_6-3CO_2=C_6H_6$, therefore it is a benzol with 3(COHO), substituting $_3H$!

In order to parallel the cogency of this logic, I would say of the thousands or millions of organic bodies which similarly break up into oxalic acid, that, therefore they are oxalic acids with the infinity of residues replacing, &c., &c.

M. Schorlemmer, before the Royal Society (CHEMICAL NEWS, vol. xix., p. 196), similarly says, the oxidation products of propylic glycol are carbon dioxide, and acetic acid, which proves that the structure of the glycol is expressed by the formula $CH_3—CH(OH)—CH_2OH$.

Another authority, with like wonderful prevision, says that hydrocinnamic acid is $C_6H_6+CH_2-CH_2-COHO$, and the saltic type is $(C_9H_9O_2)_2Ca+1\frac{1}{2}H_2O$.

Another insists that the acid, with 2H less than cinnamic acid, $C_{18}H_7O_2+HO$, and therefore $C_{18}H_5O_3+HO$, coumaric acid, is phenyl-propiolic acid—

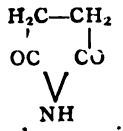
$$C_6H_5C$$
$$\|$$
$$C$$
$$|$$
$$CO_2H$$

Professor A. Matthiessen thinks that all the reactions of narcotine may be accounted for by the following rational (?) formula:—

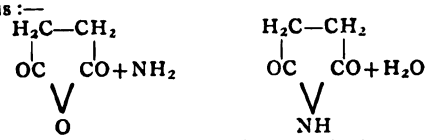
$$\left.\begin{matrix}CH_3\\(C_{11}H_9O_2)'''\\(C_8H_4O)''''\\(CH_3)_2H\end{matrix}\right\}N\Big\}O\Big\}O_3$$

By a singular distortion of an intellectual process, some have thought that the simple principles of mineral

chemistry might be employed to gradually unravel the greater complexities of organic combination. Professor Wanklyn has corrected this error, and shown that, in the simple salts and hydrates of soda, lie hidden the mysteries of triatomic and septatomic quantivalence: we must not go from the simple to the complex, but rather work out principles or fantasies from organic chemistry, and then apply them to the old binary compounds of mineral chemistry. Time was when the relation of acid to amide was a matter of great simplicity, but M. Erlenmeyer now sees much farther. Succinimide is—



and its origin from anhydrous succinic acid and ammonia is thus:—



To give but a faint description of these modern pleasantries of atomic mechanism would fill large volumes. We can only add in this brief glance, that they are from men of undoubted eminence and great practical ability.

Enough has been said to justify our hesitation in adopting any of these multifarious modes, and in the pressing desiderata to lay hold of some wide generic principles which may afford some comprehensive grasp of the whole contour of organic metamorphosis; we humbly, and *pro tem.*, fall back on the old binary principles of Berzilian and Lavoisierian chemistry, as best fitted for the widest and most comprehensive grasp.

We assume, until a wider and better theory can be offered, that such radicals as methyl (C_2H_3), ethyl (C_4H_5), propyl (C_6H_7), acetyl (C_4H_3), and a vast infinity of analogues do exist, and that, as hydrides, they are characteristic indifferent bodies, while with O, Cl, S, and other negative elements they form bases or acids, and other more neutral bodies, perfectly paralleled by the more simple elements of mineral chemistry.

The confidence and dogmatism with which such types and names as we have indicated are obtruded upon notice will be in no way imitated. We shall try to lay hold of leading types, ever bearing in mind that they must necessarily be subject to manifold ways of isomeric variation. The ground to occupy is of too wide and extensive a character to permit of special exactitude; but this attitude should in no way be opposed to rigid scrutiny or microscopic investigation at any stage of the process. The harvest is indeed ripe, and manifold labourers are wanted in every direction; workers in the laboratory and watchers of the wide horizon. Our meaning in this direction will perhaps be better understood by an illustration.

We deem, then, the term phenyl-propiolic acid almost as barbarous as the older term, "sulphuric ether." Now that we have an infinity of ethers, including a true sulphuric ether, it surely behoves us to carefully control their nomenclature.

In what way the radicals phenyl and propyl may combine to form the acid in question is a legitimate matter of detail, nor can we afford to wait long upon such minutiæ. To us the great question is, Is there a hydrocarbon radical ($C_{18}H_5$) comparable with acetyl (C_4H_3), or cinnamyl ($C_{18}H_7$), &c., &c.?

Our meaning may further be seen in regard to the body aceton, $C_6H_6O_2$. Its origin and subsequent reactions led very generally to the idea of its being a hydride of acetyl, $C_4H_3O_2,H$, in which the H was replaced by the gaseous methyl, $(C_2H_3) = C_4H_3O_2,C_2H_3$.

While recognising the validity and value of this aspect as one of the elements of isomeric variation, yet would we stoutly urge the great necessity for a due subordination of this phase of organic combination. To give it undue prominence, as is too often done, and coin a shibboleth of hard names, is positively confusing and detrimental.

It has only just transpired that, by the simple and direct oxidation of the hydrocarbon propane or hydride of propyl, we get a body possessing all the characters of acetone, $C_6H_6O_2,H$.

The distinction between the two types is one of great importance, because the hydrocarbons proper are comparatively few and capable of a simple generic classification, while such types as acetone, $C_4H_3O_2,C_2H_3$, are capable of an infinite variation, nor do I see any hope of embracing them in any generic arrangement.

It only remains in this short introduction to offer a few thoughts as to why we still adhere to the old notation in regard to O, S, C, and other doubled atoms of modern theory.

Among other reasons, O is doubled because its ordinary volume is half that of H. The same anomaly subsists in the volumetric character of the phosphorus, arsenic group, and some have pushed theory so far as even to double these, but that is generally discountenanced on the ground that the anomaly disappears in their various compounds, where the volumes agree with the atomic weights in a way perfectly comparable with the one volume, N.

			Density.	Atomic Weight.
Ammonia ..	H_3,N	2 vols.	17	17
Phosphonia ..	H_3P	,,	34	34
	&c., &c.			

We moot that the same argument is strictly applicable for oxygen also.

It is monatomic and replaces chlorine, &c., in organic radicals where the volumes correspond normally; in other words, the densities are as the atomic weights.

			Density.	Atomic Weight.
Hydride of acetyl	$(C_4H_3O_2)H$	2 vols.	22·04"	44
	$(C_4H_3Cl_2)H$	,,	49·70"	99
	&c., &c.			

Hydrides are normally two vols., whence their densities are half their atomic weights, but these radicals themselves are normally one vol., and their densities exactly correspond with the atomic weights.

		Density.	Atomic Weight.
H	1 vol.	1	1
$(C_4H_3O_2)$ ..	,,	43	43
$(C_4H_3Cl_2)$..	,,	98	98
	&c., &c.		

Also in organic acids the densities and atomic weights agree in innumerable cases of proto-, sesqui-, bi-, and tri-acid forms where chlorine and oxygen are perfectly paralleled.

Again, oxygen, in conjunction with C = 6, and S = 16 replaces H in ammoniacal types, and here also the densities and atomic weights agree.

	H_3N.		Density.	Atomic Weight.
Ammonia	HH_2,N	2 vols.	8·5"	17
Ethyl mustard oil	$(C_4H_5)(CS)_2,N$	,,	43·7"	87
Methyl ,,	$(C_2H_3)(CS)_2.N$	,,	37·8	73
Amyl ,,	$(C_{10}H_{11})(CS)_2,N$	,,	63·4	129
Butyl ,,	$(C_8H_9)(CS)_2,N$			
	&c., &c.			

and, by a generic action, these, by addition of ammonia, form fluosinnamin types of sulph-ureas.

Urea	$H(CO)_2H_3N_2$
Fluosinnamin ..	$(C_6H_5)(CS)_2H_3,N_2$
Butyl sinnamin ..	$(C_8H_9)(CS)_2H_3,N_2$
&c., &c.	

Lastly. Monatomic oxygen replaces H in the general phenomena of substitution, mainly like chlorine.

The oxidations, chlorodations, and sulphodations of carbydrogens, rich in hydrogen, present a unity of action; and the bases split up to negative or acid forms, by similar intermediate stages of hydride or indefinite bodies, where O = 8; S, 16; and Cl, 35·5, replace each other with volumes and atomic weights in perfect harmony.

We now take a glance at the amide and glucoside modes of production.

Amides.

The study of these bodies some years ago afforded the writer great interest:—

1. As possessing such new and varied phases of ammoniacal type.

2. As proving the adequacy of plain and simple principles to guide without ambiguity or mystification into the profound depths of the science.

3. As proving that *one generic formula of reaction* or production seems to give amides, hydramides, ureides, or ureas, amide acids, urethanes, &c., &c.

4. As providing the strongest arguments against the modern doctrines of mono-, bi-, and tri-basic acids, and the similar mono-, bi-, and tri-amines.

In this connection I can only refer to one aspect of this wide field, viz., its tendency to resolve hitherto unexplained groups of organic combination. If I mention two such groups it is not so much because success appears to attend the very onset, as to elicit a co-operative or corrective criticism.

On the one hand, I have long felt puzzled at the existence of an apparently aberrant group of carbohydrogens with even instead of odd ratios of H, and have marked out for investigation what may, perhaps, be called *the malic acid group*.

This group is exceptional in the even number of H atoms in the radical, whereas all other acid series have only odd numbers of H. A special study of this group might throw some light on the problem why all the carbon constituents have even numbers, and the H part odd numbers, while the oxygen seems normally to affect even numbers in the radical.

The first step in the process is evidently to apply the generic formula in question, and the peculiarity seems to stand that test, for

Malate of A − 2HO gives Malamide . . . . . $(C_4H_3O_3)H_2N$
Bimalate of A − 2HO ,, Malamic Acid (Aspartic) $2(C_4H_3O_3)H_2N,O$
Aspartate of A − 2HO ,, Aspartamide (Asparagin) $2(C_4H_3O_3)H_4N_2$

Most books say that malamide or asparagin is found in the asparagus, in marsh mallow, and some other plants, but, although of the same composition, they are not identical, and I think my notation and a recognition of the ureal or atmonia type of asparagine will clear up the difficulty. I cannot see the least reason or advantage in doubling this acid to make it square with the modern notion of bibasic acids.

In "Fownes" (9th edition), its structure and derivation is compared with that of the oxamide series. In both cases, the acids and neutral salts are doubled, while the acid salts (binacids?) and their derived amides contain no more acid than the mono or neutral forms, and yet the prefix *bi* is retained.

I ought, perhaps, to have pointed out that, by an extension of the formula, when the acid is an ammoniacal one, then the result is an ureal amide, thus—

Carbamate of A − 2HO = Urea . . . . . $2(CO)H_4N_2$
Aspartate of A − 2HO = Aspartamide (asparagin) $2(C_4H_3O_3)H_4N_2$
&c., &c.

On the other hand, there seems a tolerably wide range of combination with unusual and intractable ratios of oxygen, and with little or no H in the compound, as in the

Mellitates, $HO+C_4O_3$
Croconates, $HO+C_5O_4$
Rhodizonates, $HO+C_6O_7$
Saccharates, $HO+C_6H_4O_7$
&c., &c.

How, then, does this generic action apply to such cases?

Carbonate of Ammonium − 2HO, gives Carbamide.
Bicarbonate of ,, ,, ,, Carbamic acid.
Oxalate of ,, ,, ,, Oxamide.
Binoxalate of ,, ,, ,, Oxamic acid.
Benzoate of ,, ,, ,, Benzamide.
Bibenzoate of ,, ,, ,, Benzamic acid.

$$H_4NO+CO_2-2HO=(CO)H_2N$$
$$H_4NO+2CO_2-2HO=2(CO)H_2N,O$$
$$H_4NO+C_2O_3-2HO=(C_2O_2)H_2N$$
$$H_4NO+2(C_2O_3)-2HO=2(C_2O_2)H_2N,O$$
$$H_4NO+C_{14}H_5O_3-2HO=(C_{14}H_5O_2)H_2N$$
$$H_4NO+2(C_{14}H_5O_3)-2HO=2(C_{14}H_5O_2)H_2N,O$$
&c., &c.

The infinity of amides thus produced are hydride, indifferent or non-combining bodies, mostly affecting the crystalline form of needles, and insoluble; in all probability they are of the type H_2N,H. Whatever ammonia is in type, constitution, and general properties, that, in all probability, are the amides.

The amic acids are ammoniums, H_4N,O, definite combining bodies, and de-doubling with basic, intermediate, or acid functions just in proportion as the substitutional equivalents rank higher or lower in the electro series.

Malate of Ammonium − 2HO gives Malamide.
Bi-malate of ,, −2HO ,, Malamic (aspartic) acid
Succinate of ,, −2HO ,, Succinnamide.
Bi-succinate of ,, −2HO ,, Succinnamic acid.
&c., &c.

It is curious to compare these simple and consistent notations with the confused variations of modern theory. Any fundamental appeal to the guidance of law is wholly lost in the doubling of atoms, and the varied estimates of water of hydration in the several compounds submitted to the amide formula.

In extending this list considerably, I am well aware there are chemical reasons for doubling the atom in some cases where, indeed, that process may, in all probability, be necessitated: I only contend that this should be done with extreme caution, and not without a survey of the several relations.

As to the doubling of succinic acid, I find the following remark in my rough notes:—"M. Fehling, and also M. Cahours, seem quite sure that succinic acid is tribasic, like the phosphates $3HO+C_8H_3O_5$; and, between the chemical reasons urged by the bi- and tribasic claimants, I could not see a pin's difference whereon to found a preference; but, where all is so empirical, the simple truth may have a strong advocate in M. Dopling, from whose elaborate paper I copy an extended series of succinates $(MO+C_4H_2O_3)$, with the usual variation of type in ascending the series into the weaker bases, where two and three atoms of base are found, as in the corresponding acetates, sulphates, &c."

Many salts affect two volumes, but there are several whose densities are as one volume, as in the

Succinate of ethyl, $EO+C_4H_2O_3$,
Succinate of methyl, $MeO+C_4H_2O_3$,
Oxalate of ethyl, $EO+C_2O_3$,
Silicate of ethyl, $EO+SiO_2$,
Oenanthate of ethyl, $EO+C_{14}H_{13}O_3$,

and others.

The theoretical application of this formula to the second group would be thus—

Mellitate of A − 2HO = Mellitamide?
Bi-mellitate of A − 2HO = Mellitamic acid?
$H_4NO+C_4O_3-2HO=(C_4O_2)H_2N$?
$H_4NO+2(C_4O_3)-2HO=2(C_4O_2)H_2N$?

There is encouragement to think that these bodies may be obtained when duly sought for. Fownes says, "Mellitate of A yields, by distillation, two curious compounds—paramide, a white, amorphous, insoluble substance, containing C_8HNO_4 (*i.e.*, bimellitate of ammonia − 4HO), and

convertible, by boiling with water, into bimellitate of ammonia;" and euchronic acid, a colourless, soluble, crystalline body, containing, in the anhydrous state, $C_{12}NO_6,2HO$.

In this case, it is almost certain that paramide is the amide or ammonia form of mellitamic acid, evincing as it does the widely generic property of re-conversion, by boiling water, into bimellitate of A.

Here, then, we get a new substitutional representative of H; and, if one H can be replaced by (CO), (C_2O_2), or (C_4O_2), surely that does not end the series; and have we not more complex acids which may be explained by a similar process, and their radicals identified?

And, seeing that silicium is now so close a congener with carbon, may not a similar extension of law be applicable in the infinitely varied silicates of mineralogy?

Euchronic acid appears to be a varied mellitamic acid—thus, $3(C_4O_2)HN,O$.

Glucosides.

The manuals of chemistry present a strange variety of types in regard to the constitution of the sugars, and also complex acids containing higher ratios of oxygen; but there are considerations which seem to encourage the hope that both these intractable groups may, ere long, be embraced within the limits of simple law.

The hypothesis herein is twofold; 1st, That glycols, glycerines, mannites, and sugars are all monatomic alcohols; 2nd, That complex organic acids with high ratios of oxygen are substitutional variations of simpler types.

For a fuller exposition of these views, I must refer to a separate article on the constitution of the alcohols; but, for brevity, I here append a note on the aceto-nitrates, or, as I should prefer to call them,

Nitro-Acetates.

It is said that these belong to the water type $\left.\begin{matrix}H_6\\H_6\end{matrix}\right\}\Theta_6$, in which H_6 is replaced by ferricum $Ffe^{vi.}$, and 1H is replaced by $(N\Theta_2)$

No. 1.
$\left.\begin{matrix}H_6\\H_6\end{matrix}\right\}\Theta_6$
Type.

No. 2.
$\left.\begin{matrix}Ffe^{vi.}\\H_6\end{matrix}\right\}\Theta_6+2H_2\Theta$
Normal ferric hydrate.

No. 3.
$\left.\begin{matrix}Ffe^{vi.}\\4(C_2H_3\Theta)'\\(N\Theta_2)'\end{matrix}\right\}\Theta_6+4H_2\Theta$
Tetra-aceto-nitrate of iron.

No. 4.
$\left.\begin{matrix}Ffe^{vi.}\\3(C_2H_3\Theta)'\\(NH_2)'\\H_2\end{matrix}\right\}\Theta_6+2H_2O$
Tri-aceto-nitrate of iron.

No. 5.
$\left.\begin{matrix}Sr''\\(C_2H_3\Theta)'\\(N\Theta_2)'\end{matrix}\right\}\Theta_2$
Aceto-nitrate of strontian.

No. 6.
$\left.\begin{matrix}Ba''\\(C_2H_3\Theta')\\(N\Theta_2)'\end{matrix}\right\}\Theta_2$
Aceto-nitrate of barium.

If, in these compounds, (NO_4) really replaces 1H of acetic acid, and, further, presuming that, in the three and four atoms of acetic acid, only one atom is so modified, then the formulæ might be thus—

$$\left.\begin{matrix}\text{(No. 6). } 2BaO+AcO_3,HO\\\text{(No. 5). } 2SrO+AcO_3,HO\end{matrix}\right\}\ AcO=C_4H_2(NO_4),O_3$$

$$\left.\begin{matrix}\text{(No. 4). } 2Fe_2O_3+3AcO_3,7HO\\\text{(No. 3). } 2Fe_2O_3+4AcO_3,HO\end{matrix}\right\}\ 1AcO=C_4H_2(NO_4),O_3$$

It only remains to compare these notations with the ordinary types of similar true acetates; and methinks all seems quite fair and simple; nothing strained, nothing outlandish. No new principles, no 6-atom water types are at all requisite! As to the 6-atom *normal* ferric hydrate, it is clearly $3HO+Fe_2O_3$.

What is this ferricum if it be not 2 atoms of ferrosum? and yet this latter is said to be tetratomic, while the former is hexatomic!

Ferrosum $=Fe^{iv.}=(56)$. Ferricum $=Ffe^{vi.}=(112)$. As a general rule in such cases of substitutional variation, I prefer to retain, if possible, the supposed normal type, with a dash referring to a marginal explanation; also to retain the dash in cases where some unknown substitutional variation may be presumed.

Some vigorous effort is needed to restrain the amazing fecundity by which the multiplication of types and hard names have become a pest to the science.

				Sources.	Acid.			Base.		
1. Acetic Ether	C_4	H_4	O_2	—	Acetic acid	$HO+C_4\ H_3\ O_3$		+ Alcohol	$C_6\ H_6\ O_2$	$-2HO$
2. Stearine	42	42	8	Animal fats	Stearic acid	$HO+36\ 35\ 3$		+ Glycerine	6 8 6	$-2HO$
3. Bi "	78	76	9	" "	" "	$HO+72\ 69\ 5$		+ "	6 8 6	$-4HO$
4. Tri "	114	110	12	" "	" "	$HO+138\ 103\ 7$		+ "	6 8 6	$-6HO$
5. Salicine	28	18	14	Willow bark	Saliginine	$HO+14\ 7\ 3$		+ Sugar	12 14 14	$-4HO$
6. Populine	40	22	16	Aspen bark	—	$HO+28\ 11\ 5$		+ "	" " "	$-4HO$
7. Phloridzine	42	24	20	Cherry bark	Phloretine	$HO+30\ 13\ 9$		+ "	"	$-4HO$
8. Quercitrine	38	18	20	Quercitron bark	—	$HO+24\ 7\ 9$		+ "	"	$-4HO$
9. Esculine	42	24	20	Horsechesnut	Esculetine	$HO+18\ 5\ 7$		+ 2 Sugar	2(")	$-10HO$
10. Paviine		—		Ash bark	—	—	—	+ Sugar	"	—
11. Saponine		—		Soap wort	—	—	—	+ "	"	—
12. Frangulin	40	20	20	—	—	$HO+28\ 9\ 9$		—	—	$-4HO$
13. Plobaphen	52	24	28	—	Oak red	—	—	—	—	—
14. Caincin	48	39	21	Chiococca Ramosa	Chiococcin	$HO+36\ 27\ 9$		—	—	$-2HO$
15. Amygdalin		—		—	—	—	—	—	—	—
16. Rubian		—		Madder root	Alizarin?	—	—	+ Sugar	—	—
17. Indican		—		"Indigofera"	Indigo red?	—	—	+ "	—	—
18. Antiarine		—		"Antiaris"	Yellow resin	—	—	+ "	—	—
19. Murrayin	72	44	40	—	Murrayetin	$HO+48\ 23\ 19$		+ 2 Sugar	2(12 12 12)	$-4HO$

2 and 3.—It remains to be seen whether these substitutions take place in the acid or in the base—precedents are equally available for both cases; and this alternative applies to the whole series. The StO_3 of No. 3 would be

$$\overbrace{C_{36}H_{34}(C_{36}H_{35}O_2)}O_3,$$

that of No. 4 would be—

$$C_{36}H_{33}(C_{36}H_{35}O_2)_2O_3.$$

6.—The acid, 28 11 5, easily splits into benzoic acid, whence it may be that this acid is of type No. 5, with radical of benzoic acid (14 5 2) replacing 1H.

The acid, 30 13 9, splits into phloretic acid, 18 9 5, whence it may be that acid with 1 (12 5 4) replacing 1H. Phloridzine gives a characteristic ammonia phloridzeine, just as orcine gives a similar ammonia orceine; and I subsequently find orcine is associated with a lichen sugar!

18.—Antiarine is—C, 61·2; H, 8·1; O, 30·7. Its yellow resin is—C, 83·9; H, 9; O, 4·2.

These studies have afforded much pleasure in the prosecution; but, while our leading chemists are eagerly pursuing other routes, they are presented with diffidence and humility, in the hope that other minds may be induced to take stock of progress, and to enquire whither we are tending, and what are the materials elaborating in our workshops or laboratories for the popularisation of science.

PRELIMINARY NOTE ON NAMAQUALITE.

By A. H. CHURCH, M.A.

SOME time ago I obtained from Mr. J. R. Gregory a few pieces of a beautiful blue silky mineral which he had obtained during his recent visit to South Africa, from one of the copper mines of Namaqualand. The qualitative examination of the mineral proved it to contain copper, aluminium, and water, with traces of calcium, magnesium, and iron. Several specimens were crushed into fragments, and the pure homogeneous parts picked out for quantitative analysis. The percentage numbers correspond pretty closely with the formula $Al_2H_6O_6,3CuH_2O_2,4aq$.

The constitution of this mineral appears to warrant the bestowal of a specific name; the locality of its occurrence suggests that of *Namaqualite*. I am engaged in completing the investigation of the physical and chemical characters of this compound; but I may now mention that it occurs in thin layers made up of short silky fibres, and is of a pale blue colour. The layers alternate with another copper mineral, which is amorphous, and is probably chrysocolla. Namaqualite has something of the aspect and texture of a soft variety of crocidolite, or of chrysotile. The absence of silica from namaqualite is remarkable. As far as at present made out, it would seem to be a cupric aluminic hydrate, hitherto unrecognised.

ON SOME MEANS FOR

PREVENTING THE BUMPING OF BOILING LIQUIDS.

By HUGO MÜLLER, F.R.S.

THE annoyance which arises from the bumping of certain liquids when submitted to distillation or boiling has often attracted the attention of chemists, and various means have been proposed for its prevention.

The value of pieces of platinum, charcoal, burnt clay, and other porous bodies for this purpose is well known, and, under certain circumstances are efficient enough; yet there occur very frequently cases in the laboratory when these means are unavailable.

About two years ago Pietro Pellogio (*Fresenius, Zeitschr.*, vi. Jahrg.) proposed a very simple contrivance, which was stated to act very satisfactorily indeed. It consisted of a moderately wide glass tube, passing through the cork of the tubular of the retort, and nearly reaching the bottom of it, the upper end being bent at right angles and drawn out into a capillary tube.

Having occasion to try the efficiency of this arrangement, I came to the conclusion that it was quite ineffective, and shortly after, G. Hager (*Pharmac. Centralhalle*, Bd. 9) confirmed the negative results I obtained.

Quite recently E. Winkelhofer (*Ber. d. Chem. Gesellsch. Berlin*, p. 194, 1869), proposed for the same purpose the application of an electric current, which, through the incipient decomposition of the liquid and consequent evolution of gas, causes the ebullition to become quite regular and steady. Dufour, for another, with another object in view, had made use of the same means.

The application of the electric current unfortunately pre-supposes that the liquid to be distilled is a sufficiently good conductor of electricity; and, if this is not the case, necessitates the introduction of such substances as shall cause the liquid to become a conductor. This circumstance, therefore, limits very considerably the use of this otherwise efficient arrangement, and it is on this account that I venture to bring under notice some other means which I have tested in a variety of cases, and which invariably proved satisfactory.

In cases where the introduction of any foreign matter into the liquid about to be distilled is undesirable, I introduce through the cork in the tubular of the retort a glass tube, which is drawn out to a long capillary tube and pressed tightly to the bottom of the retort. The upper end of the glass tube is connected, by means of an india-rubber tube, with a generator of carbonic acid, or hydrogen, or a gas-holder containing air, and whilst the distillation is going on, one of these gases is passed in a slow but continuous current through the liquid. Under these conditions, all bumping is avoided, and the distillation proceeds with the utmost facility.

For ordinary purposes, however, I have found it still more convenient to introduce into the liquid about to be distilled a small fragment of sodium amalgam or, in cases where the liquid is acid, a small piece of sodium-tin. Methylic alcohol is well known to be one of the most difficult liquids to distil, yet, on the introduction of a minute piece of sodium amalgam or sodium-tin, it can be distilled without the slightest inconvenience. I found on one occasion that more than 400 grammes of methylic alcohol distilled over with perfect steadiness, and without exhausting the activity of a fragment of sodium-tin, weighing not more than 0·060 grms.

It is, perhaps, hardly necessary to mention that the action of sodium amalgam and sodium-tin is due to a minute but continuous disengagement of hydrogen taking place during the process of distillation.

ON

HEAT TREATED AS A SCIENCE OF KINETICS.*

By G. F. RODWELL, F.C.S.

(Continued from p. 26).

III. (ABSTRACT).

THIS lecture was chiefly devoted to a consideration of the effects produced by heat within a mass of matter, and the various forms of action which it then assumes. The following definitions, which are taken from the "Notes," convey the principal points of the lecture.

The attractive force existing between the molecules of matter, like all other attractive forces, decreases in intensity as the distance between the attracting molecules increases, and *vice versâ*. Liquids become solids (*solidification*) when they lose so much of their molecular motion that the molecules approach sufficiently near to each other to produce the effect of rigidity, in place of the former molecular mobility. (*α*). When the resulting solid assumes a definite geometrical form (*crystallisation*), the attractive force of its molecules probably varies in intensity in different directions; thus, supposing the molecules to be spherical, the attractive force would be greater or less in the direction of a diameter A than in the direction of a diameter B, cutting A at right angles; or, supposing the molecules to be ellipsoidal, the attractive force would be greater or less in the direction of the major axis than in the direction of the minor axis. (*β*). When the resulting solid does not assume a crystalline structure or form, the attractive force of the molecules probably does not vary in different directions, or the varying intensity may be equalised by extraneous causes (*amorphous solidification*).

When molecular motion is communicated to a substance, it is obvious that, before it can expand that substance, it must overcome the mutual attraction of its molecules at the particular distance at which they then exist; for expansion is the act of increasing the distance between individual molecules (*vide* Lecture II.) In thus separating the molecules, there is, consequently, a certain amount of work to be done (*the internal work of a mass of matter*), just as the separation of two masses—for instance, the raising of a weight to a height above the surface of the earth—involves the expenditure of an amount of work equal to the force of gravity which has been overcome, and, in both cases alike, heat is consumed in the per-

* A course of four lectures delivered at the London Institution.

formance of the work done. And as when a weight is raised above the surface of the earth it possesses potential energy (*vide* Lecture I.) competent, when converted into kinetic energy, to cause it to fall through the space which separates it from the earth, and to generate the heat consumed in raising it when its kinetic energy is arrested, so, likewise, the molecules of a substance expanded by heat possess potential energy (*molecular potential energy*) competent to cause them to recross the space through which they have been separated by the added molecular motion, and to generate the heat consumed in separating them when the kinetic energy thus induced is arrested.

And since all matter possesses a certain amount of molecular motion, and no two molecules are in contact, it follows that all molecules possess a certain amount of potential energy, and that the acts of heating and cooling, (addition and subtraction of molecular motion) may be expressed respectively as the increasing and the lessening of molecular potential energy, considered in regard to its amount at the time of such addition or subtraction. (The first part of this assertion may be otherwise expressed by saying that nothing is so cold that it cannot be made colder; ice may be called excessively hot when compared with solid carbonic anhydride; in a word, the former possesses a far larger amount of molecular motion than the latter. The *absolute zero of temperature* is believed to be $-273°$ C., and we must imagine that the molecules of matter would be in contact at this temperature. Matter thus constituted would be perfectly lifeless and inert; it would possess no motion, neither could its molecules transmit any motion. We have not yet succeeded in producing a degree of cold approaching the absolute zero. The rapid evaporation of liquid ammonia *in vacuo* in the presence of sulphuric acid produces a temperature of 87° C. below zero; liquid nitrous oxide in becoming gas reduces the temperature to $-88°$ C.; solid carbonic acid produces a temperature of $-90°$ C., and when mixed with ether and placed *in vacuo*, of $-100°$ C., while the greatest artificial cold has been obtained by the rapid evaporation *in vacuo* of a mixture of liquid nitrous oxide with disulphide of carbon, when the temperature fell to $-140°$ C. By the employment of a freezing mixture of solid carbonic anhydride and ether, simultaneously with excessively high pressures, Andrews has reduced nitric oxide to 1-680th of its original volume, oxygen to 1-554th, and hydrogen to 1-500th, but in no instance did these gases exhibit signs of liquefaction. It is obvious that in the case of compressible matter pressure will tend equally with loss of molecular motion to lessen the molecular potential energy).

From the above paragraphs it follows that, when molecular motion is added to molecules, it performs two functions, for a portion of it is converted into work (*vide* Lecture I.) which confers potential energy upon the molecules by separating them (*expansion*), while another portion increases the temperature of the substance (*vide* Lecture II.), by conferring upon the molecules a larger quantity of the motion which constitutes heat, and hence increasing their velocity. Thus a portion of the added molecular motion disappears as heat, and this is still known as *Latent Heat*—(*Lateo*, to lie hid, because it was imagined by those who adopted the material theory of heat (*vide* Lecture I.)that the heat thus designated was somehow hidden in the substance, as in a cave, and that it only came out under certain conditions, and this idea was one of the most notable of the many *idola specus* possessed by the Materialists).

The quantity of heat which is thus expended in interior work when a solid passes into the liquid, or a liquid into the gaseous condition, can be readily determined. Thus, if a pound of boiling water (212° F.) be mixed with a pound of ice-cold water (32° F.) the temperature of the resulting two pounds of water is found to be 122° F.; that is, the mean of the two:— $\frac{212° + 32°}{2}$ F. = 122° F. But if a pound of ice (32° F.) be mixed with a pound of boiling water, the temperature of the resulting two pounds of water is found to be only 51° F. Now it is obvious that the difference in the total heat of the two mixtures is that required to raise two pounds of water, 122° − 51° F. = 71° F., or one pound through 142° F. In other words, in the act of liquefying a pound of ice at 32° F., an amount of heat is consumed as internal work which is competent to raise one pound of water through 142° F.; that is to say, 142 units of heat (*vide* Lecture I.), which represents as mechanical work one pound weight raised to a height of 772 × 142 feet = 109,624 feet (or more than 20 miles) above the surface of the earth (*vide* Lecture I.)

The actual amount of molecular motion possessed by different substances (*specific heat*) varies considerably, for not only do the molecules in a given space vary in quantity, but also in weight, and in their attraction for each other; hence, also, the amount of heat consumed in internal work varies, because it depends upon the relative attraction of the molecules.

The amount of molecular motion necessary to raise any substance through a known number of thermometric degrees (*vide* Lecture II.) compared with that necessary to raise the same weight of water through the same number of degrees, is called the specific heat of that substance. Thus, to raise 1lb. of water 1° F. in temperature requires thirty-three times the amount of heat necessary to raise one pound of mercury 1° F. in temperature; hence, the specific heat of water being represented by 1·00, that of mercury will be 0·033.

Conduction of Heat is the transference of molecular motion from molecules possessing a certain amount of it to molecules possessing less of it, by direct communication of motion. Those molecules which are apt to receive and transmit the motion are called *conductors* of heat, while those which are unfitted for the reception and transmission of the motion (whether from their slight mobility, or from an inaptitude to accommodate themthemselves to that kind of motion) are called *non-conductors* of heat.

Convection (from *conveho*, to carry up) is an action induced by external means—the force of gravity—in virtue of which a congeries of molecules of liquid or gas, possessing a greater amount of molecular motion than surrounding congeries or system of congeries, rises *en masse*, because the motion of heat, by increasing the distance between the molecules of matter (*vide* Lecture II.) causes a given number thereof to occupy a larger space when they possess a certain amount of that motion than when they possess relatively less, whence ensues a difference of density and a consequent difference of action on the part of gravity, for in equal bulks there are now no longer equal weights of matter, and one mass is now attracted by the earth more powerfully than the other.

UTILISATION OF BLAST FURNACE SLAG.*

In this paper the author endeavours to point out some of the uses to which this almost valueless material, which is produced in very large quantity in the manufacture of iron, may be applied. He states that slag is a compound containing an excess of lime, and produced by the siliceous and earthy matters contained in the ironstone, combining with the lime of the limestone used as a flux. Grey slag contains, in 100 parts :—Silica, 38·25; alumina, 22·19; lime, 31·56; magnesia, 4·14; protoxide of iron: 1·09; manganese, a trace; sulphide of calcium, 2·95; but the composition of slag differs according to a variety of circumstances.

The author then discusses the means of converting slag into paving stones, applying it to the manufacture of sulphate of alumina, aluminate of soda, and pure silica for

* Abstract of a paper read before the Cleveland Institution of Engineers, by Mr. Crossley.

the manufacture of porcelain, for most of which purposes patents have been taken out. He then proceeds to point out a plan of his own invention in which the slag, after being brought into a suitable state of subdivision, is treated with hydrochloric acid, whereby silica is obtained in a gelatinous form, and the alumina, lime, magnesia, and iron dissolved; the solution is evaporated to dryness, washed with water to dissolve out the soluble salts, the insoluble residue is treated with sulphuric acid, by which means sulphate of alumina is formed, the solution of which may be decanted off; the silica after washing with water is left in a pure state. The sulphate of alumina may either be evaporated to obtain that salt in the solid and dry state, or it may be used for the manufacture of alum. By this process slag will give a product worth £3 per ton and another worth £7 per ton. The author uses hydrochloric instead of sulphuric acid, as it is, in many instances, a waste product. Every 100 tons of slag will yield 33 tons of silica and 147 tons of sulphate of alumina.

PROCEEDINGS OF SOCIETIES.

QUEKETT MICROSCOPICAL CLUB.

The fourth annual general meeting was held on Friday evening last, in the library of University College. Mr. Arthur E. Durham, President, in the chair.

A report was read, which showed that 142 members had been elected since the last annual meeting, making a total of 512. The Treasurer's report showed that the finances were in a very satisfactory condition.

In vacating the chair which he had filled for two years the President delivered a highly impressive address, which was listened to with marked attention throughout.

The following gentlemen were elected to fill the offices named for the ensuing year:—

President—Mr. P. Le Neve Foster.

Vice-Presidents—Dr. R. Braithwaite, Mr. W. M. Bywater, Mr. A. E. Durham, Mr. H. F. Hailes.

Members of Committee—Mr. T. Crooke, Mr. B. T. Lowne, Mr. S. J. McIntire, Dr. J. Matthews.

Treasurer—Mr. R. Hardwicke.

Hon. Secretary—Mr. T. Charters White.

Hon. Secretary for Foreign Correspondence—Mr. M. C. Cooke.

A paper "*On the Ratio-Micro Polariscope*," by Mr. James J. Field, its inventor, was read, at the conclusion of which the instrument was exhibited. Ten new members were elected, after which the proceedings terminated.

NOTICES OF BOOKS.

Qualitative Chemical Analysis. By Dr. C. Remigius Fresenius, Director of the Chemical Laboratory at Wiesbaden. Seventh edition. Edited by Arthur Vacher. London: John Churchill and Sons, 1869.

Many years ago when analytical chemistry was but little studied in this country, and the few who practised it used Rose's "Handbuch der Analytischen Chemie," Mr. Lloyd Bullock introduced a translation of the works of Dr. Fresenius on "Qualitative and Quantitative Analysis." These are so well known to chemists, and have become such thoroughly standard authorities, that it is almost unnecessary to notice a new edition.

The "Qualitative Analysis," unlike the Quantitative, has diminished rather than increased in bulk, and this arises from an increased condensation and an alteration in some respects of the arrangement of the work. "This edition," says Mr. Vacher in the preface, "differs greatly from the last. . . . The language has been condensed, the notation and nomenclature have been modernised, the arrangement has been simplified."

We are glad to notice the removal of the great mass of cross references, which formerly added so much to the already sufficient difficulties of the beginner, and which always reminded us of one of the more complex pages of "Bradshaw."

The work, as now arranged, is divided into the following sections:—1. Reagents, apparatus, and manipulation; 2. Reactions and separations; 3. General analysis; 4. Special analysis; 5. Reactions and separation of rare inorganic bodies; 6. Reactions and separation of organic bodies; 7. Detection of poisons in bodies, food, &c.; 8. Tables. The few tables which are given are eminently serviceable, and might, with advantage, be printed separately on calico for laboratory use. It is a grand mistake to print tables on paper which are to be used side by side with the test-tube rack, and to bind them up with a book; we all know how soon they become torn, and discoloured, and acid stained. Such tables, together with works on chemical manipulation, might with advantage be printed upon calico or vegetable parchment.

Every book which is meant for constant laboratory use should have a special binding, as durable as binding can be made, and, best of all, literal boards of thin oak. We have the misfortune to possess a copy of Regnault's "Cours de Chimie," bound elaborately in white vellum. An *edition de luxe* of a work on chemistry is a far more useless object than an *edition de luxe* of a treatise on the infinitesimal calculus, and may be classed with silver trowels, ivory croquet mallets, Louis Quatorze clocks, and other ornamental but useless—at least, unpractical—things. A certain great king, we are told, once presented a certain great chemist with a laboratory, in which every vessel was of platinum; this was a laboratory *de luxe*; give us good glass, say we, with a judicious sprinkling of the above precious metal, with homely porcelain and still homelier Stourbridge clay, and we will leave king's gifts to king's chemists, albeit a little Royal patronage would not be unserviceable to our science.

To return to our book; we may observe that the "Qualitative Analysis" of Fresenius is not so much in vogue as his "Quantitative Analysis," and this arises from the fact that there have arisen in our native chemical literature,—sparse though it be—various works on "Chemical Manipulation," and "Laboratory Practice;" again, many teachers adopt a special form of their own, based, perhaps, upon that of Fresenius, but differing in character and arrangement therefrom. Still it looks well to have a seventh edition of any work on chemistry in this country, and we wish Messrs. Bullock and Vacher further success. We would suggest in conclusion that the utterly inadequate index of *less than two pages* should at least be trebled in size in the next edition.

Dictionnaire de Chimie Pure et Appliqués. Par Ad. Wurtz. Paris: L. Hachette.

The first *fascicule* of this work gives us some idea of its ultimate extent: although printed in somewhat small type, and in double columns, the 160 pages carry us only as far as Allyle. We shall review the whole work at length when it appears in its entirety, meanwhile, we propose rather to call attention to its general character than to give a review. M. Wurtz is assisted in his labours by no less than seventeen *collaborateurs*, among whom we notice the names of Debray, Emile Kopp, Lauth, and Naquet. The subject matter includes—Inorganic and Organic Chemistry; Chemistry applied to the Arts, Manufactures, and to Agriculture; Analytical Chemistry, and "La Chimie Physique et la Minéralogie."

We notice in this number an admirable article by M. Salet on "Affinity," terminated by a list of works relating to the subject which commences with the *Pyrosophia* of

Barchusen (1698). We almost think that such a list is incomplete without the *Physica Subterranea* of Beccher, the *Tractatus Quinque Medico Physici* of Mayow, and the *Fundamenta Chemiæ* of Stahl, but it must be allowed that the idea of affinity possessed by these men was excessively crude and indefinite. Perhaps Otto Tachenius may also be quoted as having a glimmer of the action of predisposing affinity. The article on "Air" by M. Le Blanc is unfortunately short, and does not make mention of the more recent researches on impure and vitiated air. M. Caventon supplies an article on "Alkaloids," and he herein furnishes a very complete list of these bodies, including some which can scarcely be called familiar; for instance, Chiococcine (*Chiococca racemosa*); Ménispermine (*Menispermum cocculus*); and Surinamine (*Geoffræa Surinamensis*). In a somewhat elaborate article on "Alcohols" by Kopp, a very good description (accompanied by woodcuts) is given of the various stills which are used in the process of manufacture, among them the ingenious *appareil Champonnois*. We shall return to this work on its completion; meanwhile, we have no doubt that it will be found in every chemical library.

CORRESPONDENCE.

OLEOGRAPHS.

To the Editor of the Chemical News.

SIR,—During some months past there have been sent to me various paragraphs from general and trade newspapers, prices current, penny magazines, &c., praising Dr. Moffat's oleographs as being valuable in the oil trade, to druggists, &c., and associating them with my name. I have this day seen a notice which states that Dr. Moffat's oleographs are based on the cohesion figures of Mr. Tomlinson, "published last year!"

In the CHEMICAL NEWS for the 11th December last, (vol. xviii., p. 284) I gave the history of my discovery, dating from 1861, and published in that year, and in your number for 29th January last (vol. xix., p. 59) I recorded my opinion of these oleographs. I stated that they are without distinctive characters, and are consequently valueless as oil tests.

Unless Dr. Moffat has wonderfully improved on the specimens he sent to me I do not understand how he can sanction, or, at any rate, allow to pass uncontradicted, the puffing paragraphs to which I refer. I have not the means or the inclination to get counter statements inserted in the journals referred to, but I do hope that after this second protest in your columns Dr. Moffat will use his influence to correct the misapprehension which must arise from such paragraphs.

The cohesion figures of liquids are in themselves oil-tests; but when transferred to paper, as in these oleographs, the resemblance between the figure of one oil and that of another is so close that they may be taken as identical, and they are, therefore, for practical purposes, useless, as friends of mine connected with the oil trade have proved.

While heartily wishing success to oleography, I cannot see much prospect of it in the present state of the art, and I am sure that Dr. Moffat would not wish to describe as a finished picture that which is only a rough, and by no means correct sketch.—I am, &c.,

C. TOMLINSON.

Highgate, N., July 26th, 1869.

GASEOUS SPECTRA.

To the Editor of the Chemical News.

SIR,—Our attention has been drawn to a letter from Mr. W. Huggins, in your impression of the 9th instant, stating that, in a recent note to the Royal Society (in which we announced that, by varying the conditions of pressure and temperature, we had reduced the spectrum of hydrogen, as seen in our instrument, to one line absolutely, and the spectrum of nitrogen to one line nearly), we did not notice similar observations of his own presented to the Royal Society in 1868. In reply, we beg to state—First, that we did notice Mr. Huggins's observations, and, secondly, that they were not similar to our own.

With regard to the first point. The account you were good enough to publish contained the following:—"The bearing of these latter observations on those made on the nebulæ by Mr. Huggins, Father Secchi, and Lord Rosse is at once obvious. The visibility of a single line of nitrogen has been taken by Mr. Huggins to indicate possibly—First, 'a form of matter more elementary than nitrogen, and which our analysis has not yet enabled us to detect;' and then, secondly, 'a power of extinction existing in cosmical space.'

"Our experiments on the gases themselves show not only that such assumptions are unnecessary, but that spectrum analysis here presents us with a means of largely increasing our knowledge of the physical constitution of these heavenly bodies."

We thus gave briefly the results of Mr. Huggins's enquiries, and references to where a complete account of his observations were to be found. This we considered to be sufficient, seeing that our communication was a preliminary note only. In the complete account of our researches to be subsequently presented to the Royal Society we shall, of course, dwell upon them at greater length.

With regard to the second point—the similarity of the observations. In 1864, Mr. Huggins first observed the spectrum of the nebulæ, and determined that one of the lines was coincident with one of the air lines due to nitrogen, the spark being taken close to the spectroscope. On this Mr. Huggins wrote:—"The speculation presents itself, whether the occurrence of this one line only in the nebulæ may not indicate a form of matter more elementary than nitrogen, and which our analysis has not yet enabled us to detect." Some time afterwards, Mr. Huggins, instead of taking the air spark close to the spectroscope, placed it outside the object glass of his telescope, and then only saw one line in the spectrum—the line in question. He next got similar results close to the spark by interposing a dark glass to cut off the light, still using the spark in air at the ordinary pressure, and remarked that it was "obvious" that the hydrogen spectrum would give similar results. Then, after stating "we cannot suppose that any lines have been extinguished by the effect of the *distance* of these objects from us," he refers to the possibility of a "power of extinction residing in cosmical space," and the hypothesis of the more simple form of nitrogen appears to be given up.

Now, with regard to our own observations, we have *not* taken the spark in air; we have *not* used a dark glass; we have *not* worked at atmospheric pressure; nor have we disturbed the normal distance of the experimental tube from the slit of our instrument until we had reduced the complicated spectrum of nitrogen to one bright line and three or four other extremely faint ones. Further, we have *not* rested content with any assumption with regard to hydrogen, nor have we regarded anything as obvious.

What we have done is to carefully watch both spectra changing as the pressure becomes less, trying the effect of increased and decreased temperature at every stage under various conditions, which we shall state in our detailed paper.

It may be as well to refer, in conclusion, to Plücker's important work on nitrogen, which shows that, under certain conditions, the green line of nitrogen vanishes altogether from the spectrum. This fact alone shows at once the importance of our method of inquiry.—We are, &c.,

E. FRANKLAND.
J. NORMAN LOCKYER.

Royal College of Chemistry, Oxford Street, July 23, 1869.

MISCELLANEOUS.

Preservation of Protosulphate of Iron.—M. Welborn states that proto-sulphate of iron is absolutely preserved and kept from even the very least trace of oxidation, by placing with it a piece of camphor wrapped in a piece of clean and dry paper.—*Deutsche Ind. Zeitung.*

Preservation of Meat.—M. Georges recommends to place the meat into a bath containing 86 parts of water, 10 parts of common salt, 4 parts of glyceric acid or *acide vineux*, (glyceric acid is prepared by the author by mixing equal parts of glycerine, water, and hydrochloric acid; *acide vineux* is made in the same way, but instead of glycerine alcohol is added); after this fluid has become thoroughly soaked into the meat it is pressed and squeezed, and next covered with a layer of fat.—*Deutsche Ind. Zeitung.*

Action of Carbolic Acid on Reptiles.—We have been favoured with extracts from an account of some very valuable experiments made by J. Fayrer, F.R.S.E., C.S.I., &c., on the value of carbolic acid in preventing the entry of serpents into dwellings, from which we find that a few drops of the acid are sufficient to quickly kill full-grown cobras and other poisonous snakes. Dr. Fayrer is continuing his experiments on the merits of carbolic acid as a therapeutic agent in snake bite, and, in the meantime, he suggests its use as a preventive against the entry of snakes into houses, &c. Dr. Calvert informs us that it is probable that the acid will save life by applying it, in a caustic state, to the wound caused by the bite of a serpent, and more satisfactory results will be obtained by following the method first put into practice by Dr. Tessier in the Mauritius, for the cure of a virulent intermittent fever. In this case, by injecting under the skin a solution of three-quarters of a grain of carbolic acid dissolved in 20 minims of water, the patients were rapidly cured, and the spread of the pestilence arrested.

Experiments with Flame.—Dr. Hofmann, F.R.S.—Take a piece of canvas, such as is used by ladies for Berlin wool work, and put it on to the top of the superior opening of the glass chimney of an argand gas burner, taking care to envelope the glass chimney previously with a very thin piece of copper foil, while the access of air at the bottom of the burner should be as much as possible prevented. On turning the gas on, it escapes readily through the small openings in the canvas, and the gas may be ignited above. The canvas, however, soon takes fire and burns off, but leaves a very complete circular disc, which remains white and unconsumed in the centre of the frame. If it is desired to demonstrate more completely the nature of the flame, it is done by placing, on the middle of the canvas disc, some gunpowder, and on it the heads of some lucifer matches. After having again turned on the gas, and left it to escape for a few moments, it may be kindled again, and will burn quietly, and even though, as in the first experiment, the excess of canvas again burns off, neither the gunpowder nor matches will catch fire until just at the moment the gas is gently turned off. In order to exhibit the reducing action of the interior portion of a Bunsen gas flame, a spirally rolled-up piece of copper wire is held in the interior portion of the flame by means of a pair of forceps. When this spiral is taken out of the flame while red-hot, and exposed to contact of air, it becomes covered with a black coating of oxide of copper; but if the spiral, instead of being taken out of the central portion of the flame is lowered down into the current of gas, and there cooled, it will exhibit on, withdrawal, a clean and bright metallic surface.—*Berichte der Deuts. Chem. Ges. zu Berlin.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Programme de la Société Hollandaise des Sciences de Harlem, Année, 1869.

On the 15th of May, the general yearly meeting of this scientific society was held at Harlem. The meeting approved of the proposal made by a committee, to found two additional medals, each of the intrinsic value of 500 florins (about £42), one of which will bear the name and effigy of Huyghens, the other that of Boerhaave. These medals are intended to be given, every alternate two years, to those scientific men, native or foreign, who, by their researches, discoveries, or inventions, shall, according to the opinion of the Society, have most contributed, during the last twenty years, to the advancement of a specific branch of physico-mathematical, or natural history sciences. The Huyghens medal will be awarded, in 1870, to natural philosophy; in 1874, to chemistry; in 1878, to astronomy; in 1882, to meteorology; and in 1886, to mathematics (pure and applied). The Boerhaave medal will be awarded, in 1872, to mineralogy and geology; in 1876, to botany; in 1880, to zoology; in 1884, to physiology; and in 1888, to anthropology. The preliminary award shall be made according to the advice of a committee to be appointed by the directors of the Society, of which committee the secretary of the Society shall be a permanent member. The final award shall be made at the general yearly meeting of the Society, after it shall have discussed the report and heard the full explanation given by the committee just alluded to.

Among the questions open for competition, and to be answered on or before the first of January, 1871, we notice the following:—

The Society asks for an accurate description of all chemical or physical operations, whereby either accidentally, or as a consequence of direct experiments, chemical compounds have been obtained, which, by their chemical and physical properties, agree with native minerals. The Society does not desire that new minerals should be artificially formed, but simply an accurate and critical review of the results already obtained; while it is also requested that all the published and printed memoirs wherein such artificially-made minerals have been described shall be fully mentioned.

The Society desires a monograph on albuminous substances; this work to include an historical sketch of all the researches made concerning these substances, and a critical review of the divers opinions which, at the present day, are current in science in reference to these materials.

The Society desires that the co-efficients of expansion, by heat, of divers kinds of glass, and more especially the glass used for making thermometer tubes, be very accurately determined, according to M. Fizeau's method, for temperatures according to the centigrade scale, from $-30°$ downwards to $500°$ upwards.

Since more recent researches appear to confirm the opinion that the substances known as hydrates of carbon are polyatomic alcohols, the Society desires that new researches be made in order to clear up and fully elucidate this point.

Since the accurate determination of temperatures above 350° is a matter open to great improvement, the Society has decided to grant its gold medal to him who shall succeed in the construction of a simple apparatus whereby temperatures up to 500° are correctly indicated.

The Society asks accurate determinations of the various indices of refraction of water, for at least 12 points of the spectrum, over a range of 50°.

It is well known that the Aurora Borealis causes telluric electric currents, which occasionally disturb the proper action of the electric telegraph wires; the Society desires that, on telegraphic lines of great length, the force of these currents be determined, and that it be also ascertained how far these currents extend towards the equator.

The two questions which the Society desires to receive replies upon, on or before the 1st of January, 1873 (both bearing upon natural history), we need not quote, but specially notice the following questions to which answers are expected on or before the 1st of January next, these questions having been propounded and published last year:—

Since it cannot be denied that spectrum analysis, now almost the order of the day, has been overrated, and its value exaggerated, it is desired that, in order, also, to obtain more sound views on this matter, that which is true and that which is false therein be equitably sifted; that the limits be stated up to which this method is of legitimate use, and beyond which it fails to be applicable; and, lastly, that a critical review be made of all facts brought to light by this branch of experimental research, and, also, that it be pointed out what science has to expect of its extended application.

The electric current heats the metallic conductor which is traversed by it; hence the resistance the current experiences is increased, and in this manner the current reacts on itself. We may, on the other hand, suppose that the intensity of the current modifies the value of this resistance by virtue of an action which does not directly depend upon the heating. It is desired that the influence exercised by the intensity of the electric current on the degree of resistance be investigated in both points of view just mentioned. Among the metals which seem to offer the best chance of success for this kind of investigation, mercury holds a prominent place.

The repetition, extension, and criticism is asked of the experiments concerning the electrolysis of the fused haloid salts (Faraday's "Experimental Researches," T.I., art. 538 and following, and 978 and following); also an *exposé* of the theories of the nature of electrolysis which can be deduced therefrom. Faraday's law of electrolysis is very simple; but the question is not yet exhausted, and the whole phenomenon is obscure. It is therefore desired that it should be rigorously decided up to which point the above-mentioned experiments are in opposition with this higher view, and aided by a great many facts, according to which no real electrolysis whatever should take place unless the action of the current be only exerted upon double salts, or upon combinations equivalent and analogous therewith.

According to M. G. Ville (see his *Revue des Cours Scientifiques*, 1868, No. 7, p. 103), nitrogen, in its free or elementary state should be assimilated by some kinds of plants, especially those belonging to the *Leguminosæ*; the Society therefore asks that this opinion be submitted to a critical examination, and that the truth or falsity of this opinion be fully made out on theoretical as well as on experimental ground.

In reference to the extremely interesting and highly-valued experiments of Mr. Graham, Master of the Mint, the Society asks for new researches on the absorbing and dissolving power of molten metals for hydrogen gas, especially with the view to determine whether there

do exist definite combinations of hydrogen and metals. The Society desires to have experiments made with various metals, in order to ascertain, with certainty, the fact whether the assertion that metals become transparent at a sufficiently high temperature holds good, or is to be rejected.

Since there yet exists a great deal of uncertainty on the subject of the cause of the phosphorescence of substances called artificial phosphori, the Society requests that a thorough research be made to establish the fact that this phosphorescence is only due to a slow oxidation.

Whilst the pressure of the air, the direction and force of the wind, and the temperature of the air are continuously recorded at the meteorological observatories, by means of self-acting and self-registering instruments, the degree of moisture of the air is as yet only recorded by a few isolated observations made at certain hours of the day-time. The Society desires the construction, either upon an entirely new plan, or according to the principles indicated (see *Poggendorff's Annalen*, vol. xciii., p. 343), of a self-acting or self-registering instrument for determining the degree of moisture of the air, and the publishing of results of observations obtained by means of such instrument for at least one half-year continuously.

The Society desires to recommend, to the competitors for prizes, to omit, in their answers to questions, any matters not directly relating to the proposed question; it is, moreover, desired that, whatever be sent into the Society should be worked out with precision, and that every proposition be well defined and demonstrated, and not mixed with vague theories or badly digested and not well established facts. The memoirs sent in must on no account whatever be written in the handwriting of the authors themselves, since, if even these memoirs might be worthy of the award of the medal, and it turned out that such documents were written in the author's own handwriting, no award whatever could be made, according to the Society's rules. The envelopes added to the memoirs sent in, and appended thereto by a peculiar mark, and containing the author's name, will, in case no award is granted, be destroyed by fire, unopened. The memoirs to be sent in for competition may be written in Dutch, French, Latin, English, Italian, or German languages, at the author's option, provided, in the case of the German language, the italic, and not the peculiar German mode of writing, be used. All such documents, and the envelopes appended thereto, and just alluded to, should be sent, carriage or postage paid, to Dr. E. H. von Baumhauer, the Secretary of the Society, residing at Harlem, North Holland, Netherlands.

The prize offered for a satisfactory memoir, or answer, to each of the proposed questions, is the Society's gold medal, value 150 florins (£12 10s.), bearing the author's name and the year of issue, or, if the author might desire it, the full money value of the medal; in some cases, it is left to the umpires of the awards to grant an additional award of 150 florins. The competitor to whose memoir a prize shall have been awarded may not, without the express consent and authorisation of the Society, print or publish, either in whole or part, separately or in any periodical, the memoir to which the prize has been awarded.

Polytechnisches Journal von Dingler, vol. cxcii., No. 5, first part for June, 1869.

We notice the following original papers and communications in this number:—

Researches made in the Laboratory for Technical Chemistry at Brunswick.

a. **Abnormal Behaviour of Saccharate of Lime.**—M. Waldeck. It is a well-known fact that the combination of lime and sugar yields, with cold water, a clear solution, which, on being heated, becomes turbid, or even gelatinises. A solution having been prepared, by mixing, with a solution of pure sugar in water, an excess of slaked lime, shaking this mixture, and afterwards filtering it; on heating this solution, no turbidity ensued at all. This phenomenon gave, of course, rise to further investigation, when it was found that the lime which had been applied in this instance was chemically pure hydrate of lime. On mixing some of the same sugar solution with lime as ordinarily obtained from lime-kilns, it was found to exhibit again the phenomenon of becoming turbid on heating. At first sight, therefore, it would appear as if chemically pure lime behaved differently with sugar solution from what ordinary lime does; but further investigation into this matter brought to light the fact that, owing to the necessity of obtaining a fresh supply of sugar, this substance, and not the lime, was the cause of this discrepancy. The author found that, although at first sight no difference could be detected in the refined sugars applied, yet the last-obtained sample behaved, both with the chemically pure and ordinary lime, in the same manner, yielding a solution which becomes turbid on heating; both kinds of sugar were refined white loaf sugar obtained from the same place and at the same price. Of the first sample, yielding abnormal results, unfortunately no more was obtainable, and therefore the matter remains in some obscurity; but those who are connected with sugar refineries might take this hint, and, perhaps find a valuable means of distinguishing between various samples of refined sugar.

b. **Manufacture of Soda from Sulphate of Soda and Oxide of Iron.**—M. Waldeck.—The author points out that the manufacture of soda from its sulphate, and by the intermedium of carbon (charcoal or small coal) and oxide of iron, would be, in many aspects, a great improvement upon the Leblanc process. He next mentions some experiments to illustrate his views on this subject. He took 105 parts, by weight (three atoms), of sulphate of soda; 40 parts, by weight (1 atom), of peroxide of iron; and 25 parts, by weight (eight atoms) of carbon. This mixture fused readily; treated with water, it yielded a solution which, on passing therein a current of carbonic acid gas, became quite clear, leaving only 2·79 per cent of insoluble residue. However fair the results these experiments gave on the small scale, the author is himself unable to solve a difficulty which, on the large scale, would be an absolute impediment to the action; to wit, that neither cast nor wrought-iron vessels—and, worse yet, no fire-clay crucibles, or furnaces built with fire-bricks—will stand the action which is called into play, leaving out of the question the necessity of absolute exclusion of air during the fusion.

On a Dolomitic Marl, and its Use in the Making of Cement. L. Gatschenberger.—In the neighbourhood of Heidelberg, a marl occurs which, after being prepared for that purpose, yields a cement of the following composition, in 100 parts:—Lime, 44·22; magnesia, 17·77; peroxide of iron, 3·07; alumina, 5·75; protoxide of manganese, 2·33; soda and potassa, 4·72; silica, 22·14. The author had the opportunity of experimenting with the marl itself; and he states—"I find there are two different modes of obtaining from this marl an excellent hydraulic lime—1st, to burn the marl at a temperature below 400°, whereby the magnesia only loses its carbonic acid, while that from the lime is not expelled; 2nd, to burn the marl at a very elevated temperature, whereby the material is even somewhat fluxed. In the first instance, the magnesia is the active matter, since I have found that it hardens under water with carbonate of lime perfectly well, but not with caustic lime. In the second instance, the magnesia loses, indeed, its hydraulic properties, but, instead thereof, its activity towards silica is so increased as to behave therewith as lime does in such cases. The author finds that the cement obtained by the application of the very high temperature, is preferable to the ordinarily-obtained hydraulic cements. A very good cement made at high temperature contains, for 100 parts of SiO_2,R_2O_3, 304 parts CaO,MgO, whereby the proportion between lime and magnesia is as 2 to 1.

On Alkanin.—Prof. Boettger.—The author states that M. Hirzel, at Leipzig, prepares alkanin, the extract of the alkanet root *anchusa tinctoria*, on the large scale. This extract is dissolved in absolute alcohol; and with this solution strips of Swedish filtering paper are saturated, and made use of, after drying, for detecting even the very faintest traces of ammonia. The alcoholic solution exhibits a beautiful red colour, which, even by the ammonia present in tobacco-smoke, or in illuminating gas, is instantly converted into a beautiful blue. The alcoholic solution and the test-paper have, of course, to be kept carefully excluded from all ammoniacal fumes. The red paper may be turned into blue by a very weak aqueous solution of carbonate of soda, and it then becomes an excellent test for even the faintest trace of any acid, turning red therewith at once.

Preparation of Pure Oxygen Gas at the Ordinary Temperature.—Prof. Bœttger.—The author says that, when a mixture is made of equal parts, by weight, of peroxide of lead and peroxide of barium, and there is poured on this mixture dilute nitric acid of a strength of 9° Beaumé, and specific gravity 1·067, a current of pure oxygen, free from ozone and antozone, is given off abundantly. The mixture of the two peroxides alluded to may be kept together in a stoppered bottle in dry state for any length of time.

Analysis of Palm-Nut Meal and Palm-Nut Cake.—Prof. Hohmann.—Palm-nut meal contains, in 100 parts—Water, 8·55; albumen, 19·56; fatty matters, 1·19; starch, 47·73 woody-fibre, 20·04; ash, 2·93. Palm-nut cake contains, in 100 parts—Water, 10·0; albumen, 15·1; fatty matters, 15·9; starch, 41·0; woody-fibre and ash, 18·0. These substances are obtained from the *Elaïs equinensis*, and used as fodder for cattle.

Vol. cxcii., No. 6, second number for June, 1869.

This periodical contains the following papers bearing upon chemistry, and sciences intimately allied thereto:—

Coating of Glass, Porcelain, or Earthenware with a Thin Film of Lustrous Metallic Platinum.—Prof. Bœttger.—Dry chloride of platinum, freed from excess of acid, is mixed, in a small porcelain mortar, with essential oil of rosmarine (*Oleum anthos*) until the original brown-red colour of the salt has entirely disappeared, and has been converted into a black, pitch-like looking mass. In order to effect this result, it will be necessary to renew the essential oil at least three times. When the pitch-like mass has been obtained, the oil is entirely removed, and the pasty mass is weighed, and afterwards mixed with at least five times its weight of lavender oil, and mixed therewith to a homogeneous fluid; this, after having been quietly standing for half-an-hour, is applied with a hair brush on the glass or porcelain objects to which it is desired to give a coating of lustrous platinum; and, after the very thinly and evenly laid on film is dry, the objects are either placed in a red-hot muffle, or heated in the flame of a glassblower's lamp, care being taken not to exceed a red heat.

Black Patina upon Zinc.—M. Neumann.—The author has instituted a series of researches to find out the best and most suitable material to produce upon zinc—or rather upon statuary and ornamental objects made of that metal—a pleasing blackish coating, without the necessity of impairing the effect of the natural colour of the metal, as would be the case when an oil-paint or varnish is used. The best results were obtained by the author when nitrate of protoxide of manganese was used: this salt, on being heated, is decomposed, yielding black peroxide of manganese, and the degree of heat required is not so high as to affect the zinc. To 1 litre of pure water, 54 grammes of the nitrate alluded to, and containing six equivalents of water of crystallisation, is, according to the author, the best solution for this purpose; and the specific gravity of that solution, at 14° R., is stated by the author to be 1·125.

Saponification of Fats when in the state of Emulsion.—M. Waldeck.—This paper confirms the results formerly obtained by M Mège-Mouries. The author of this memoir points out that

forming an emulsion of fats by means of substances such as gum, for instance, would be impracticable for the manufacture of soap, entailing, as it would do, loss of lye as well as of the gum or other similar substance; he, therefore, in consequence of the results obtained by him in experiments expressly instituted, advises the use of alkaline lye for the purpose of forming emulsion; but, if that plan be resorted to for soap-making purposes, the use of distilled water is an absolute requisite, but, of course, no impediment at all, since, where steam is used, distilled water is readily enough obtainable. The emulsed fats are very rapidly and readily saponified.

Portuguese Graphite.—M. Knublauch.—In 100 parts, this material was found to contain—Water (hygroscopic as well as of combination), 10·21; carbon, 38·47; ash, 50·81.

Consumption of Divers Materials used as Substances for the Production of Artificial Light.—Dr. Willigk.—This paper, although very interesting, is too lengthy to admit of useful abstraction.

On a So-Called Disinfecting Soap.—Dr. Pincus.—The author very properly calls attention to an error committed by a chemist and a soap manufacturer, who state that they have succeeded in obtaining a soap which contains permanganate of potassa as an active and disinfecting ingredient. On investigation by the author, he found, as might be expected, that even the freshly made soap only contained oxide of manganese, and a mere trace of permanganate. This latter salt, of course, cannot be kept for any length of time in contact with an organic material, as soap is, without becoming decomposed. The soap was made by incorporating into well-made, hard soap, quite dry, and cut into shreds, powdered permanganate, and then forming this mixture into a cake by strong pressure.

Annales du Génie Civil, No. 6, June, 1869.

This periodical contains a lengthy paper—

On Wine.—M. Boucherie.—Composition of must and of wine the former contains—Sugar, a nitrogenous principle which is fit for; fermentation, ferment, or active yeast, a colouring matter contained in the skin of the grape, but, as yet, not dissolved in the liquid, and oxygen and nitrogen. Wine contains carbonic acid, a small quantity of grape sugar alcohol, amylic alcohol ($C_{10}H_{12}O_2$), butylic alcohol ($C_8H_{10}O_2$), propylic alcohol ($C_6H_8O_2$), campholic alcohol ($C_{20}H_{18}O_2$), several essential oils (the nature of which is not precisely known), oenanthic ether, aldehyde, valeric acid, acetic acid, butyric acid, glycerine, and the colouring matter of the skin of the grapes dissolved in the alcohol formed by the fermentation. Wine and must, moreover, constantly contain water, organic non-crystallisable matter, gum-like substances (as pectin and dextrin), mannite, and nitrogenous substances; and also the following crystallisable organic acids:—Tartaric, racemic, tannic, malic, pectic, and citric. No *free* mineral acids. The following salts of organic acids and inorganic bases:—Bitartrate of potassa, tartrate of lime, tartrate of alumina, malate of potassa, malate of lime, pectate of potassa, pectate of lime; divers acetates, further nitrates, phosphates, sulphates, silicates of the above-named bases, and also chlorides, iodides, bromides, and fluorides of these bases; while wine contains infinitesimal doses of soda, oxide of iron, alumina, oxide of manganese, magnesia, and ammonia. The quantity of alcohol naturally present in 100 parts of wine varies very considerably, and varies according to the locality where it is grown, the climate during the time when it was grown, and the variety of grape from which it is obtained. For red Bordeaux wines of average good quality, the quantity of alcohol varies from 8·10 to 10·85 per cent (the author does not state whether he means by bulk or by weight). For white Bordeaux wines, it varies from 9·25 to 15 per cent on average good wine and divers brands. For Burgundy wines (red variety), the quantity of alcohol varies from 10·10 to 13·09 per cent; white variety from 12·22 to 14·90. Good Roussillon contains about from 16·20 to 17·25 per cent of natural alcohol. White hermitage wine contains, on an average, 16·0 per cent of alcohol. Effervescing champagne contains 11·20 per cent of alcohol, while genuine port wine contains naturally from 22·50 to 23 per cent of alcohol, and marsala as much as 25·09 per cent. This alcohol, be it understood, is absolute and anhydrous.

The other papers of this periodical are devoted, as might be surmised from the title, to matters quite foreign to the subject just briefly abstracted, and of no direct interest to our readers.

Zeitschrift fur Chemie, von Beilstein, No. 11, June 26, 1869.

This periodical contains the following original papers:—

Synthesis of Crotonic Acid.—M. Stacewicz.—The author says—My starting point is taken from the well-known constitution of the acrylic acid series, and this made me expect to succeed in synthetically preparing crotonic acid, according to the scheme expressed in the following formulæ—

$$C_3H_3\left.\begin{matrix}ClO\\H\end{matrix}\right\}O + C_2H_4Cl + 2Ag = C_3H_3(C_2H_3)\left.\begin{matrix}O\\H\end{matrix}\right\}O + AgCl.$$

The experiment was crowned with success, but the acid obtained differs from that prepared from cyanide of allyl. The mixture of chloracetic acid, chloraceten, and silver is heated, in a sealed tube, up to 140°, and, after the end of the reaction, the contents of the tube are submitted to fractional distillation. At 127°, an oily fluid is obtained, soluble in water, exhibiting a feebly aromatic smell; this fluid reddens blue litmus paper, and acts, when in contact with the skin of the human body, as a blistering agent. The silver-salt of this acid, $C_3H_3AgO_2$, is difficultly soluble in water, and crystallises in dendritic groups; the formula for crotonic acid is, therefore—

$$C\left\{\begin{matrix}H\\CH_2.CH_3\end{matrix}\right.$$
$$C\left\{\begin{matrix}O\\OH\end{matrix}\right.$$

On Chlorinated Toluidine, and a New Mode of Preparation of Bromobenzoic Acid.—M. Wroblevsky.—Chlorinated toluidine is prepared by passing through acetotoluid, $(C_7H_8O)HN.C_7H_7$, chlorine gas, whereby chloracetotoluid is obtained, which is purified by repeated re-crystallisation from its solution in water. This substance, which is composed according to the formula—

$$C_6H_3Cl.(CH_3).NH(C_2H_3O),$$

crystallises in large foliated crystals, fuses at 99°, is readily soluble in alcohol, less so in water; on being boiled with an alcoholic caustic potassa solution, acetic acid is formed, and chlorotoluidine—

$$C_6H_3Cl(CH_3)NH_2.$$

It is a colourless fluid, boils at 222°, is soluble in alcohol, but almost insoluble in water. From ortho-bromotoluol, a colourless liquid, which boils at 182°, the author prepared, by treating it with bichromate of potassa and sulphuric acid, ortho-bromobenzoic acid; this is a solid substance, which fuses at 153°, and then sublimes in long needle-shaped crystals, identical with those of the same compounds as obtained from benzoic acid.

On Sulphate of Lime and Potassa.—M. H. Struve.—This double salt was first discovered by M. Phillips, in the year 1850. The author of this paper says—When crystals of sulphate of lime are put into a saturated solution of sulphate of potassa at 12° (the specific gravity of that solution being 1·0716, and containing 9·41 per cent of the anhydrous sulphate of potassa), the crystals of sulphate of lime are soon converted into somewhat bulky pseudomorphic crystals of the double salt of sulphate of lime and potassa. When the solution of sulphate of potassa is more dilute, the change takes place more slowly; and when, in 100 c.c. of water, only 2·365 grms. of sulphate of potassa are dissolved, the sulphate of lime is simply dissolved therein without forming a double salt; burnt gypsum and native anhydrite behave in the same manner. The formation of similar double-salts takes place, but more slowly, when sulphate of lime is put into concentrated solutions of the chloride, bromide, and iodide of potassium; the same takes place with solution of nitrate of potassa.

New Mode of Formation of Anhydrite.—M. Struve.—100 parts of sulphuric acid (sp. gr. 1·82) dissolve, at ordinary temperature, 1·992 parts of artificial anhydrite (anhydrous sulphate of lime) and 1·953 parts of native anhydrite. When, to a quantity of 4 grms. of crystallised gypsum, were added 135 grms. of the same sulphuric acid, a solution was obtained which contains, for 100 parts of acid, 1·059 parts of $CaOSO_3$. When the solution of $CaOSO_3$ in SO_3HO is diluted with its own weight of water, a complete precipitation of gypsum took place after a time; no lime could be detected in the filtrate.

Preliminary Notices.—M. Wislicenus.—This paper treats briefly—

On Sulphaceton, and on the Conversion of β Oxybutyric Acid into Crotonic Acid.—As, however, the author states that his researches are as yet incomplete, and will be treated more fully hereafter, we abstain at present from further notice of them.

Researches on Piperinic Acid.—MM. Fittig and Mielck.—This is a lengthy memoir, chiefly treating on the products of oxidation of piperinic acid, which, when acted upon by permanganate of potassa in aqueous solution, yields a crystalline substance (formula, $C_7H_6O_3$), which body the authors called *piperonal*. It is difficultly soluble in cold water, more readily in boiling water, and very soluble in alcohol; it is in every way soluble in the latter fluid and in ether at the boiling temperature of these fluids. Piperonal fuses at 37°, and boils, without decomposition, at 263°. Piperonylic acid, $C_8H_6O_4$, is obtained in small quantity, simultaneously with the last-named substance, during the action of permanganate of potassa; moreover, piperonylic acid is readily obtained from piperonal by the action of permanganate. The acid just alluded to is a solid substance, crystalline, soluble in water and alcohol, fusing at 227·5°, subliming already below its point of fusion; it is a monobasic acid. Nitric acid acts most energetically upon piperinic acid, even when the former is dilute; the result of this reaction is the formation of an amorphous reddish-coloured substance, which baffled the efforts of the authors in obtaining reliable analytical results. After having, at great length, described the bromine reaction upon piperinic acid, the authors state that their researches are not as yet sufficiently complete to enable them to speak with confidence about some of their results.

Synthesis of Acids Homologous with Cinnamic Acid.—MM. Fittig and Bieber.—According to M. Bertagni's statement, cinnamic acid is formed when oil of bitter almonds is heated with chloride of acetyl; relying on this fully borne out statement the authors thought that when, instead of acetylchloride, homologous chlorides were taken, homologues of cinnamic acid would be formed; this idea has been experimentally tested, and the authors met with correct results; when equal equivalents of oil of bitter almonds and butyryl chloride are mixed and heated in sealed tubes, first to 100°, the reaction takes place, but only slowly; at from 130° to 140°, the reaction is more rapid, but yet takes several days for its completion; an acid was obtained of the formula, $C_{11}H_{12}O_2$, which the authors have named phenyl-angelic acid, because it stands in the same relation to cinnamic acid as angelic acid stands to acrylic acid; the quantity of acid obtained in this reaction is very small, the greater portion of the oil of bitter almonds being converted into a blackish resin, insoluble in solution of carbonate of soda.

On Ethyl-Phenol.—MM. Fittig and Kiesow.—Ethylphenol is prepared in pure state from ethyl benzol sulphate of potassium, which is

submitted to distillation at from 270° to 280° after having been mixed with thrice its weight of hydrate of potassa; the purification of the raw product thus obtained is a slow and tedious process; at length a solid substance, partaking of a regular crystalline form and fusing at about 48° is obtained; this body is the ethyl-phenol—

$$C_8H_{10}O = C_6H_4 \begin{cases} C_2H_5 \\ HO \end{cases}$$

it boils at 210°, but volatilises even at ordinary temperature.

On Amido-Benzoic and Nitrophtalic Acids.—M. Faust.—When nitrophtalic acid is reduced by means of tin and hydrochloric acid, amido-benzoic acid is formed, which is in every respect identical with amido-benzoic acid obtained by other means; it is a crystalline solid, containing, in 100 parts, C, 61·3; H, 5·1; O, 34·6. The author says he desires to rectify a statement made in a former number of this periodical, wherein he described as an ether what has afterwards been ascertained to be nitrophtalic acid—$C_6H_3(NO_2)O_4.C_2H_5.H$.

Conversion of Aldehyde into Aceton.—M. Schloemilch.—The author states, as a preliminary notice, *pour prendre date*, "I have succeeded in doing what is indicated under this heading, but am as yet occupied with further researches on this subject." This observation also extends to the contents of the brief notices of the following subjects:—

On Lepides and Oxylepides.—M. Limpricht.

On the Bromo-Substitution Products of Dibenzyl.—Same author.

Synthesis of Anhydrous Lactic Acid.—Dr. Von der Briiggen.—The author says, when anhydrous lactic acid is considered as being an ether, it follows that it must be possible to obtain this acid by the action of bromo-propionic acid on lactate of potassa; this, the author states he has actually carried out experimentally. His paper, however interesting, is so filled with formulæ, exhibited somewhat in the style of genealogical tables, that it would take up more room than we can afford, and therefore content ourselves with announcing in this brief notice the scientific *fait accompli*.

Preparation of Oxalate of Acetonin.—M. E. Mulder.—Aceton is added to sulpho-carbaminate of ammonium; the crude sulpho-carbaminate of acetonin thus obtained is washed with alcohol of 90 per cent, next dissolved in water, precipitated by means of perchloride of mercury, filtered; H_2S is passed through the filtrate; the latter is evaporated to dryness on a water-bath, the residue treated with absolute alcohol (which leaves $ClNH_4$ undissolved, and keeps hydrochlorate of acetonin in solution): water is next added, then again evaporated to dryness, the residue treated with $C_2O_4Ag_2$ in excess, filtered, the filtrate again evaporated to dryness, and afterwards exhausted with absolute alcohol until nothing more is dissolved; the oxalate of acetonin deposits from the solution and is purified by re-crystallisation; it exhibits a beautifully crystalline mass. Formula—

$$C_2O_2.C_{18}H_{20}N_2O_2 + 2H_2O.$$

The following are only preliminary notices on the respective subjects, of which more full research is going on:—

Kreatin and Aldehyde.—MM. Mulder and Moutheran.

Action of Bromine on Butyrate and Valerianate of Silver.—M. Borodin.

Isomers of Valerianic Acid.—Dr. Schneider.—The remainder and smallest portion of this number is, as usual, devoted to abstracts from divers papers, *Comptes Rendus*, &c., which are chiefly of last year's date, and already noticed by us.

No. 12, June 30, 1869.

This number does not contain any original papers at all, but we find in it some communications taken from a paper or periodical published in Switzerland, but, as stated, only printed for private circulation among the members of a society for the diffusion of useful knowledge, established at Zürich. The first of these papers is on the

Solutions of Iodine in Water and Aqueous Solution of Iodide of Potassium.—Messrs. Dossios and Weith.—The authors prepared, in the first place, perfectly pure distilled water, and employed pure iodine, free from chlorine, which they dissolved in the water, and which they ascertained to be, by means of volumetrical estimation with hyposulphite of soda, 0·01519173 grm. of iodine in 1000 c.c. of water. They found this quantity of dissolved iodine increased already after two days, and gradually increasing more and more, so much so that, about three months after having been first made, the solution contained nearly twice as much iodine. The authors ascertained the presence of hydriodic acid, conclusively proving that decomposition of water takes place. The authors also instituted a series of experiments to ascertain whether solutions of iodine in aqueous solutions of iodide of potassium are chemical combinations, or simply mixtures. The result of their experiments is not favourable to the idea that these solutions should be chemical combinations, since it is readily possible to withdraw the iodine from these solutions not only by simple solvents of iodine, but even by the passing through of a current of air. From some quantitative experiments made with perfectly pure materials, it appears that, at a temperature of 7·9°, and with solutions wherein the quantity of iodide of potassium varies from 1·802 to 12·643 per cent, the quantity of pure iodine thereby dissolved ranges from 1·173 to 12·060 per cent.

Combinations of Ammonia with Cyanide of Silver and Sulphocyanide of Silver.—M. Weith.—The author says that, when cyanides in solution are treated with ammoniacal solution of silver, a crystalline compound of cyanide of silver and ammonia, $CNAgNH_3$, is obtained, which, either on exposure to dry air, or by being placed in water, loses the ammonia; but this compound is, after all, the author states, a true combination, and not a mixture. Sulphocyanide of silver and ammonium, $CNS.Ag.NH_3$, is obtained when sulphide of silver is dissolved in warm and concentrated ammonia. It is a crystalline solid body, which is readily decomposed on exposure to air, but which may be heated up to 200° when surrounded by ammonia solution.

Behaviour of some Double Cyanides towards Ammoniacal Solution of Silver.—M. Weith.—With the view of separating the cyanogen from ferrocyanide of silver by means of peroxide of mercury, according to a plan published by Prof. Rose, the author of this paper found that this decomposition only takes place very incompletely and slowly. The same was observed when it was tried to decompose the aforesaid ferrocyanide by means of hydrate of potassa. The decomposition is, however, very readily and completely effected by boiling the ferrocyanide of silver with liquid ammonia; in that instance, the iron is separated as oxide; while the solution contains cyanide of silver and cyanide of ammonium—

$$Cy_6FeAg_4 + 2NH_3 + H_2O = FeO + 4AgCy + 2NH_4Cy.$$

The author calls attention to the fact that it is stated that ferrocyanide of silver is insoluble in liquid ammonia. This is right to a certain extent; but even in the cold, and more so on being gently heated, this fluid will exhibit, after filtration, and on addition of a few drops of dilute sulphuric acid, a more or less copious precipitate of cyanide of silver. When ferrocyanide of silver is mixed with an ammoniacal solution of nitrate of silver, instead of with ammonia only, and heat is applied, the iron is separated as oxide; while from this solution the whole quantity of cyanogen may be separated, on addition of a few drops of dilute nitric acid, as cyanide of silver. Ammoniacal solution of nitrate of silver behaves with ferro- and ferricyanides of potassium, with ferrocyanide of iron (Berlin blue), and other similar compounds (cobalticyanide of potassium inclusive), in a similar manner. Ferrocyanide of copper, however, cannot be treated in this manner, since the presence of copper gives rise to separation of silver in the metallic state.

The subject matter of all the other papers contained in this number has been treated in our columns already.

Journal de Pharmacie et de Chimie, June, 1869.

This periodical contains the following original papers:—

Researches on Protoxide of Nitrogen in Solution.—M. S. Limonsin.—The author says that the great solubility of this gas in water, especially if its temperature is rather low, induced him to try what the physiological effects of such a solution would be upon men (the author himself) and upon animals. With the main portion of his paper (being, strictly speaking, a chemico-physiologico experimental essay) we will not occupy ourselves. The solution of the protoxide of nitrogen in cold water, and obtained under ordinary pressure of the atmosphere, tastes sweetish, and decidedly saccharine, if, by means of pressure, water has been made to absorb a large bulk of this gas; as might be expected, this solution is readily decomposed by substances capable of taking up oxygen. The main point of importance in this paper is the anæsthetic action of the gas and solution alluded to.

Action of Chloroform upon Frommherz's Fluid.—M. Beaudrimont.—Frommherz's fluid is the *cupro-potassic tartrate*. The author's paper contains the results of some experiments made with the view to prove that, when even a very small quantity of chloroform—for instance, two drops—are mixed with 100 c.c. of water, and there is added thereto a small quantity of the double tartrate of potassa and copper, reduction of the latter takes place almost instantaneously when gentle heat is applied. The author has based upon this property a volumetrical method for the estimation of chloroform; and, notwithstanding the great volatility of that fluid somewhat interferes, the author has succeeded in his object. One equivalent of chloroform (119·5) reduces four equivalents of copper; 10 c.c. of Frommherz's liquid, containing 0·15 grm. of metallic copper, required 12 c.c. of a solution of chloroform, containing 1·195 grms. of chloroform, for 100 c.c.; while, of a solution of chloroform of twice the strength just stated—to wit, containing 2·39 grms. for 100 c.c.—just 6 c.c. were required.

Arsenical Aniline Reds—Aniline Red of M. Coupier prepared without Arsenic.—M. Roussin.—This being rather a practical receipt than a scientific memoir is not well suitable for abstraction.

The remainder of this periodical is filled, partly with abstracts from the *Comptes Rendus*, already noticed by us, and partly with papers relating to toxicology and *materia medica*.

NOTES AND QUERIES.

Testing Acetic Acid.—Can any of your correspondents oblige me by giving through your columns the readiest means of testing the purity and strength of acetic acid.—A. A.

Pattinson's Method for Extracting Magnesia from Magnesian Limestone.—The magnesian limestone is calcined at a dull red heat for some time. By this process the carbonic acid is expelled from the carbonate of magnesia only, but not from the carbonate of lime, which thus remains insoluble. The calcined mass is next reduced to a milk, with water, in a suitable cistern, and the carbonic acid resulting from its own calcination forced into it under powerful pressure. The result is a saturated solution of magnesia, the lime remaining unacted on so long as the magnesia is in excess. The solution, by evaporation, yields heavy carbonate, whilst carbonic acid gas is expelled and may be again used in the same manufacture. Our correspondent should bear in mind that only magnesian limestones can be thus operated upon.

THE CHEMICAL NEWS.

VOL. XX. No. 506.

THE SPECIFIC GRAVITIES OF LIQUIDS AND SOLIDS THEORETICALLY CONSIDERED.

By Dr. J. G. MACVICAR, Moffat, N.B.

IT is generally understood that Euclid shaped his Elements expressly to the end that ultimately he might be able to demonstrate the properties of the regular polyhedra, whose importance in every system of morphology he saw clearly; while Plato flew at them directly as the very forms of the elements of Nature. There is, therefore, nothing contrary to the traditions of philosophy in its highest walks in the supposition that the forms of the molecules of bodies, when they have been so far perfected as to have become individualised, possess the forms of the regular polyhedra. Now, if we suppose that the ultimate material element or unit of atomic weight or force is the same in all substances whatever—a supposition which has, also, the highest sanctions of philosophy in its favour, and which, though set aside for a time, begins again to be more and more favourably considered every day—and adopt the law of symmetry as the law by which these units of weight shall aggregate into groups or molecules which shall be more or less stable, we shall be conducted, by the progress of the synthesis, whether we will or no, to these regular polyhedra as the forms and structures in which that synthesis culminates, and specially to the *tetrahedron*, the *icosahedron*, and the *dodecahedron*, which are intimately related to each other.

Nor is there anything to be regretted in this conclusion; on the contrary, it is impossible for any one who has mastered the details of chemistry considered as a science of phenomena, and not of hypothesis, not to perceive—if he will but consent to look at that which implies a great revolution in this science—that this doctrine of polyhedral molecules explains a multitude of facts and phenomena, which, in all the lights the hitherto amorphous chemistry can bring to bear upon them, are utterly dark, and merely matters of wonder.

But, instead of indulging in general statements, let us prove this statement in reference to the weights of bodies, one of their most important physical properties. It will be admitted that the popular chemistry can tell whether a liquid or solid is light or heavy only after having weighed it either by the hand or the balance. Why a piece of sulphur should weigh less than twice as much as an equal volume of water, while a piece of zinc, whose atomic weight is about the same as that of sulphur, should weigh more than seven times as much, and, indeed, generally, why the weight of any body should be what it is, and not otherwise, chemistry can assign no reason. It has, indeed, a hypothesis of atomic volume by which (though not without continual embarrassments) specific gravities may be calculated; but that atomic volume is itself a function of the specific gravity as ascertained by weighing the substance; it is, therefore, merely a complication, not an explanation.

Now, the molecular philosophy which is here advocated solves the problem of specific gravities in the most satisfactory manner; for it does so not by introducing any new formula on this subject into science, but solely by the extension to liquids and solids of the law by which the specific gravities of aëriforms have been calculated ever since the days of Gay Lussac. Having found the right molecules which constitute liquids and crystals (the regular polyhedra, namely), it shows that their volumes tend to be equal, and either actually are equal or in a simple ratio to each other, just as has been long ago found in the case of aëriforms.

I have had occasion already to name sulphur: I will show the truth of what I have now affirmed in reference to sulphur and its companion oxygen, two elements which, after hydrogen itself, are the first to show themselves in our synthesis of the elements.

In the nascent state, they are so related morphologically that they may be viewed as the complements of each other, and the reciprocal forms of the same materials. They have accordingly in this their primal state the same atomic weight, and that is 8 when hydrogen is taken as unity. But so defective is the single atom of oxygen in a proper length of axis that, as often as two meet in the same neighbourhood, they must, under the law of symmetry, couple on the same axis; and thus the unit volume of oxygen gas will weigh $2 \times 8 = 16$ when $H = 1$. Similarly so defective is the single atom of sulphur (which, to prevent confusion, we may call sulph) in its equatorial region that each atom must tend to fix three others into this region; so that sulph is to be expected in nature usually in tetratoms, the atomic weight of the tetratom being $4 \times 8 = 32$, which is an atom of sulphur, a state of things which it will be desirable to indicate in symbols, thus—

The tetratom of sulph, $S_4 = \$$, one atom of sulphur.

And here I may remark that, in constituting the tetratom, the atom of sulph has come to constitute a form which is more highly oblate or negative than the single atom was prolate or positive; so that in order to lengthen the axis tetratoms, when rising into the aëriform state, tend to form unit volumes, not consisting of two atoms merely, as in the case of normal oxygen gas, but three, as in the case of that ozone which weighs 1½ times as much as oxygen gas; a mode of association being normal in the case of sulphur (except at a high temperature) which is exceptional in the case of oxygen.

If it be asked how do I come to know, or, at least, to believe, all that, the answer is that I have done so by thinking upon the subject during the leisure of a lifetime, keeping thought all the time abreast of the phenomena of nature and the laboratory. You say it is all a mere imagination, not entitled to the regard of men of science. Well, if you say so after having given this communication a fair reading to its close, I shall leave you, without further molestation, to the free enjoyment of your opinion.

I am now to deduce *à priori* the specific gravity of sulphur and its well-known combinations with hydrogen and oxygen. It is necessary only to premise further that of the two orders of forms—the trigonal and the pentagonal—under one or other of which all terrestrial elements are included, sulphur and hydrogen belong to the trigonal, oxygen and most other elements to the pentagonal. Hence, sulphic and sulphuric molecules and those in which atoms of hydrogen are centrad, must be icosahedral or tetrahedral, for, in these polyhedra, the facets are triangles, while oxygen and most other elements tend to form dodecahedral molecules, for in these the facets are pentagonal. With regard to water, whose molecule gives the unit volume for specific gravities, it is doubly trigonal (hexagonal), whence it tends to stretch out into laminæ rather than to turn round into molecules; and to constitute one particle of water no fewer than 36 atoms of vapour are required, the atomic weight of the aqueous unit consequently being $36 \times 9 = 324$, when $H = 1$. No doubt without such evidence as I cannot here reproduce, you will refuse to believe all this. But you will perceive that this reference to the weight of the unit volume of the aqueous element is not necessary to substantiate the fact of my being able to deduce the relative weights of liquids and solids. It is only necessary to enable me to present specific gravities in the usual form, that is, in relation to water as unity. And here I may mention that in giving specific gravities it is usually unnecessary to go beyond the second decimal place, because even it depends on the temperature of the experimental determination as

also on peculiarities of internal molecular structure and action which we cannot enter into.

Sulphur.—Its atomic weight is 32; its form is of the trigonal order. Its molecule of culmination is therefore icosahedral, and its volume may be inferred to be normal, that is, equal to the unit volume of water, which is the great assimilative agent on the terraqueous globe. This gives—

$$\text{Sulphur}\quad G = \frac{\S_{20}}{AQ} = \frac{20 \times 32}{324} = 1{\cdot}96.\quad \text{Exp. } 1{\cdot}96.\ 2{\cdot}0$$

Here, then, we deduce the specific gravity of sulphur, as found by the balance. I have shown also that the dimorphism of the crystals of sulphur and its plasticity, when fixed by sudden cooling under molecular change at a certain temperature, are involved in the form of this element.

Hydrosulphuric Acid.—The form of the atom of sulphur being oblate or negative, it comes to pass that, in order to lengthen its axis, it must tend to fix an atom of hydrogen on each pole, giving $H\S H = H_2\S$, which is the well-known formula of sulphuretted hydrogen. Now, of this combination, as of sulphur itself, the molecule must be icosahedral, for an atom of H must be centrad, and H is trigonal as well as $\S$. But the molecule, consisting as it does of 20 parts, and with three elements stuck into the axis of each, must be much larger than merely the icosatom of sulphur. Allowing, then, to this molecule that which after one in simplicity of ratio comes next to one, viz., two normal or aqueous volumes, we obtain for—

$$\text{Hydrosulphuric solid}\quad G = \frac{(H\S H)_{20}}{2AQ} = \frac{20(1+32+1)}{2\times 324} = 1{\cdot}05$$

Now this fœtid gas when forced down into a liquid has been estimated at 0·9, and the solid has been found to sink in the liquid. Our theoretical specific gravity may therefore be regarded as accurate. But in these forced liquids and solids it is impossible to know how much aëriform matter may be included in them, increasing their bulk without a proportional increase of weight. For this reason I shall pass lightly over sulphurous acid also. Our theory gives 1·58 as its specific gravity. The liquid has been estimated at 1·45, and the solid was seen to be heavier. The theoretical number may therefore be accepted.

Sulphuric Acid, or Anhydride.—The combination SO_3 of the most modern notation is $S_4O_6 = \S O_6$ of ours. Its form is so oblate that if two come into the same neighbourhood they must couple, giving $\S O_{12}\S = 2SO_3$ Auct. And here we obviously have the proper molecule of oxygen, namely, the dodecatom as the body of the combination, carrying a tetratom of sulph or an atom of sulphur on each pole differentiating that dodecatom. Now, these molecules are so large that if they were to form into icosatoms, as their trigonal poles would oblige them to do, they would be out of all keeping with the unit volume of water. Rather than the last of the trigonal series of polyhedrons, then the icosahedral, let us expect the first, viz., the tetrahedral molecule; we thus obtain—

$$\text{Sulphuric acid}\quad \frac{(\S O_{12}\S)_4}{AQ} = \frac{4(32+96+32)}{324} = 1{\cdot}97.\ \text{Exp. } 1{\cdot}97.$$

The tetrahedral molecule presents itself in the case of other analogous substances, that is, differentiated dodecatoms composed in great measure of elements tending to the free or aëriform state. Thus the strongest (monohydrated) nitric acid by doubling the chemical formula, as usual, gives $N_2O_{10},2HO$, which, when written symmetrically, gives—

$$\text{Nitric acid}\quad G = \frac{(HONO_{10}NOH)_4}{AQ} = 1{\cdot}55.\ \text{Exp. } 1{\cdot}55.\ 1{\cdot}52.$$

But to return to sulphuric anhydride—

Such a structure in the terraqueous globe must necessarily be very restless, and though it is found in nature (taurocholic acid, &c.) as well as has been constructed in the laboratory, the combination of sulphur and oxygen usually stops in the production of sulphates, or, as I should say, sulphurates, which are very finely differentiated, and, therefore, very stable combinations, secure from the further attacks of oxygen by being already covered on the poles by the oxygen of the metallic oxide which enters into their composition. Following the mineralogists in using a dot for an atom of oxygen, some idea of the structure of an element of a sulphurate may be given thus—

$$\text{A sulphurate}\ \ldots\ \ldots\quad \overset{\cdot\cdot}{O}M\S M\overset{\cdot\cdot}{O} = M_2SO_4\ \text{Auct.}$$

Their poles being oxygens their molecules must be dodecatoms. And as they have all undergone a severe ordeal these dodecatoms may be expected to be differentiated by the fixing of a single element of the sulphurate on each pole. Taking three of the most familiar sulphates of nature, if you make the calculation you will obtain the following results—

$$\text{Anhydrite}\ldots\quad G = \frac{(Ca_2SO_4)^{1+12+1}}{AQ} = 2{\cdot}95.\quad \text{Exp. } 2{\cdot}90.$$

$$\text{Celestine}\ldots\quad G = \frac{(Sr_2SO_4)^{1+12+1}}{AQ} = 3{\cdot}97.\quad \text{,,} \ 3{\cdot}95.$$

$$\text{Barytes}\ \ldots\quad G = \frac{(Ba_2SO_4)^{1+12+1}}{AQ} = 4{\cdot}64.\quad \text{,,} \ 4{\cdot}70.$$

It is time to remark, however, that both in nature and the laboratory the atom of sulphur often resolves itself into the four atoms of sulph of which it consists, and thus we have sulphous and sulphic acids as well as sulphurous and sulphuric. The presence of moisture especially assists in this partitionment. Taking sulphuric anhydride as the type in the absence of moisture, then, on the access of moisture to it, an atom of aq may be expected to attack and to fix itself on each of the four summits of the four atoms of sulph which constitute the poles. And after this it is only to be expected that the differentiated dodecatom, now rendered too diffuse, shall break up into four atoms of di-hydrated sulphic acid or glacial oil of vitriol, which, therefore, we must regard as the normal or most natural hydrate.

Glacial Oil of Vitriol.—It may be shown that one of its poles is sulphic and the other aqueous. Its molecule may therefore possibly be either the icosatom, consisting of 20, or the aqueous, consisting of 36 elements. But of these the latter plainly could not endure the high temperature of boiling oil of vitriol. Its molecule therefore must be icosahedral. Now

$$\text{Glacial Oil of Vitriol}\quad G = \frac{(SO_32HO)_{20}}{2AQ} = 1{\cdot}79.\ \text{Exp. } 1{\cdot}75.$$

When, however, this acid is produced in the cool of nature, and its stability increased by the incrustation of the molecule by lime, we obtain evidence that the aqua-form molecule has been constructed, the sulpho-calcic molecule being so large as to occupy four aqueous volumes. Thus—

$$\text{Gypsum}\quad G = \frac{(CaOSO_3.2HO)_{36}}{4AQ} = 2{\cdot}39.\quad \text{Exp. } 2{\cdot}3.\ 2{\cdot}4.$$

As to the strongest oil of vitriol which can be obtained by boiling, it has been observed by the best chemists that they cannot drive off the whole of the second atom of the water which is in the glacial acid. It has been observed that, strange to say, just 1-12th of an atom of water remains for every atom of monohydrate obtained. Now, here, when viewed in the light of our molecular morphology there is nothing strange. An atom of moisture has just twelve points or summits to which such bodies as atoms of oil of vitriol could attach themselves. And what has happened under the heat and violence of the long-continued boiling is obviously this, that the icosatoms of the glacial acid have been broken up, and the single elements of oil of vitriol, thus set free, have gathered round particles of moisture as nuclei, each atom of Aq being competent to accommodate 12 atoms of oil of vitriol around it.

That this is the true interpretation of the phenomenon is proved by the specific gravity. Thus—

Strongest oil of vitriol $G = \frac{(SO_3.HO)_{12} + Aq.}{AQ} = 1{\cdot}843$. Exp. 1·843.

That there are sulphurides and sulphides also, as well as sulphurates and sulphates, is shown by the same test.

Sulphuride of zinc $\frac{(Zn,SZn)_{1+12+1}}{AQ} = 4{\cdot}15$. Exp. 4·16.

But the same formula applied to galena gives G = 10·34, or, possibly, 5·17 if occupying two normal volumes, while the balance gives G = 7·4. Now, placing the metal as the body of the molecule and an atom of sulph in each pole (which must give the same percentages on analysis), we obtain—

Sulphide of lead $\frac{(SPbS)_{20}}{AQ} = 7{\cdot}4$. Exp. 7·4.

I only add that selenium comes out as baric, and tellurium as barytic sulphur, and that thallium comes out as one of a series of five metals, of which lead, gold, cadmium, indium, are other members, the body of the atom of thallium being an icosatom of sulph, and the poles atoms of sodium welded on that body.

ON

HEAT TREATED AS A SCIENCE OF KINETICS.*

By G. F. RODWELL, F.C.S.

(Concluded from p. 54).

IV. (Abstract).

This lecture was entirely devoted to radiant heat: the principal definitions are given below.

If a mass of matter possessing a greater amount of molecular motion than the matter around it (a heated ball of metal, for example) be placed in a space devoid of all directly recognisable matter (a vacuum), it is found that it rapidly loses its motion until it assumes the temperature of proximate surrounding bodies; and, inasmuch as that motion proceeds in straight lines in every direction, like the radii of a circle, the action is known as *radiation*, and the motion thus transmitted as *radiant heat*. (*Radius*, a rod, the spoke of a wheel, related to ραβδος. *Radio*, to emit beams, to shine, is not unfrequently used by the Ancients; thus Lucretius "*rubent radiati lumina solis*").

It is impossible, *à priori*, that in this case there can be direct transmission of heat by conduction (Lecture III.) or by convection (Lecture III.). The motion is not communicated to visible and readily-recognisable matter, but to that infinitely subtle matter called the *ether* or *interstellar* medium (Αιθηρ of the Ancients—Lecture I.); and it is believed to travel in progressive waves, that is, such waves as are produced when a long cord fixed at one end is rapidly jerked up and down. There is no transference of matter, only of motion; and each particle of the ether actuated by the motion moves at right angles to the direction of transmission. (The belief in the existence of a matter infinitely more subtle than air has pervaded philosophy from the very earliest times; it is distinctly enunciated in several of the older systems of Hindoo philosophy, at least 900 years B.C. It appears in Greek philosophy—most notably in that of Aristotle; and many of the Middle Age systems are founded upon this assumption. In the "Materia Cœlestis" of Descartes, we have the ether endued with various properties, inducing conditions of physical change; among others, he has assigned to it the production of all motion, an idea which accords well with Aristotle's derivation of Αιθηρ from αει and θεω. In the "Phlogiston" of Stahl, we have the ether endued with various properties, inducing conditions of chemical change, the chemical phase of the "Materia Cœlestis." In some form or other, the assumption is essential to physical philosophy; for without it all radiant actions would be quite inexplicable. In support of the existence of the ether, we have—(α) Various phenomena connected with light, as has been shown by Euler, Huyghens, Young, and others; (β) the shortening of the path of Encke's comet, the period of revolution of which is 3¼ years, which is diminished by about 0·11 of a day at each revolution; and it is probable that all the visible motions of the Universe are likewise becoming lessened by the same resistance; (γ) the experiment of Foucault on the production of heat by the rotation of a copper disc between the poles of a magnet).*

Radiant heat is closely related to light; indeed, we have every reason for believing that the motion which constitutes heat is only a slower form of the motion which constitutes light; in a word, that the difference is one of degree rather than of form. Thus, if we heat a mass of metal, it gradually assimilates molecular motion until, at a certain point (*red heat*), it emits light, and the more motion it receives, the more intense does the light become, until at length it emits white light (*white heat*). Again, when light is decomposed by a prism, that is, when the various ether waves which, in virtue of difference of oscillation, constitute differently coloured lights, are separated, so that waves of one definite velocity appear in one definite place, it is found that, beyond the slowest waves of light, there are waves of radiant heat of extreme power.

Radiant heat is capable of *reflection* (*reflecto*, to turn back); and it obeys the same laws as light. Reflection may be defined as the turning back of the ether waves by molecules which cannot assimilate the motion thus conveyed; as when a cord is fixed to a rigid body, and caused to undulate, the wave which travels along it stops when it reaches the fixed end, and then returns, because the rigid body is incompetent to assimilate the motion which the molecules of the cord convey. (This is well illustrated by causing waves to propagate themselves by rapidly jerking a cord of hemp or india-rubber fixed at one end; the cord may be from 4 to 6 millimetres in diameter; or a small brass chain, from 5 to 10 metres in length, may be advantageously employed. It should be fixed horizontally, the room darkened, and a beam of light from the electric or oxyhydrogen lamp should be caused to illumine the path of the chain. Communicated undulations are now seen with great clearness to travel to the fixed end of the chain, and, finding there nothing which can assimilate the motion, to return as a reflected wave. The undulations of a row of particles can be shown by fixing at one end a broad and lengthy band of paper, and communicating undulatory motion, as in the case of the cord. The paper best adapted for this purpose is a kind of thin drawing-paper, sold in lengths of 36 feet, and 3½ feet broad. In regard to the mirrors to be used for showing the reflection of heat, it is quite essential to success that their axes should coincide *perfectly* (in the experiment, for example, in which a hot ball of metal is placed in the focus of one mirror, and the bulb of a differential air thermometer or a thermo-pile in the focus of another and distant mirror): this can only be the case when the curves are similar, when their centres are in the same horizontal plane, and when the lines joining the opposite extremities of each curve are parallel. The focus may be indicated to the audience by allowing a cylinder of rays of light, of the

* A course of four lectures delivered at the London Institution.

* The experiments of Balfour Stewart and Tait on the production of heat by the rapid revolution of a disc *in vacuo* appeared to support the hypothesis of an ether; but a paper in the *Philosophical Magazine* for this month (January, 1869) traces the production of heat to other causes than ethereal friction. The velocity of an ether particle must be inconceivably great, since it has been calculated by Clausius that the velocity of a particle of hydrogen at the freezing temperature is 6050 feet per second; and the ether must be conceived to be infinitely less dense than hydrogen.

same diameter as the mirror, to fall upon it, while some fine dust, such as lycopodium or a little volatilised chloride of ammonium, is diffused in the air in front of the mirror; the precise position for the thermometer in the succeeding experiment of reflected heat is thus indicated. The mirrors should be parabolic, not spherical; that is to say, their surface should be generated by the revolution of an arc of a parabola about its axis, not by the revolution of an arc of a circle about the radius which unites the middle of it to the centre of the circle to which it belongs. The smaller mirrors which are sold in this country for experiments on radiant heat are, for the most part, spherical; but very good parabolic mirrors can be obtained in Paris).

Radiant heat is capable of being *refracted* (*frango*, to break up; akin to *ραγω*); that is, the motion of the ether waves may be turned, by their passage through certain media, so as to proceed in a different direction, and in an extended form.

The *absorption* (*absorbeo*, to swallow up, or devour) of heat is the reception of the motion from the ether by molecules of matter. It is thus a reverse action to reflection; for absorption pre-supposes that the molecules of the absorbing body readily assimilate the motion. Such molecules may be represented by small wooden balls suspended in the path of a cord, which latter, when caused to undulate, communicates its motion to the balls. (This action may well be shown by fixing a tense india-rubber cord in such a way that its ends may be free; this can be done by connecting it with four rigid supports by thick string, which is fastened near each extremity, and passes away to the supports, making an angle of about 60° with the cord. This tense cord represents a row of particles of ether. A leaden ball, about 3 centimetres diameter, is suspended by two strings, so as to cause it to oscillate in one plane, the end of the india-rubber cord being the limit of vibration in one direction—that is, the oscillating ball can be caused to impinge upon one end of the tense cord. At the other end of the cord, and in various positions along its path, small wooden balls, about 3 centimetres diameter, are suspended. When the oscillating leaden ball strikes the tense cord, the latter is thrown into vibration, and communicates motion to the small balls in contact with it, thus illustrating both radiation and absorption; for the lead ball represents a molecule radiating heat (viz., communicating its motion to the ether), while the wooden balls represent molecules absorbing heat (viz., receiving motion from the ether). These illustrations may appear crude, but they at least assist an audience to realise some more or less obscure molecular actions, and a mere statement of them is scarcely sufficient).

Of the total radiation of the sun, only $\frac{1}{2,300,000,000}$ths is received by the earth. In one year, the amount of heat thus received would liquefy a layer of ice 100 feet thick, covering the entire surface of the earth. With the exception of the energy of tides (that is, the energy derived from the ebb and flow of the tides, which results from the attraction of the moon, and tends to diminish the energy of the earth's revolution), the sun is the source of all our available energy—the energy of food and fuel, of water and air in motion. The most dominant attractive forces against which this energy is exerted are—(α) *Gravity*, the attraction existing between the masses of matter (Lecture I.); (β) *Chemical affinity*, the attraction existing between dissimilar molecules of matter (Lecture I.); and (γ) *Cohesion*, the attraction existing between similar molecules of matter (Lectures II. and III.) This last,—that is, the energy expended in the internal work of a mass of matter (Lecture III.),—enormous as it is, is obviously unavailable to mankind.

The concluding remarks are given below *in extenso*.

The phenomena of the Universe, infinite as they are in variety, in form, in magnitude, and in effect, appear to be almost all produced by the interaction of attractive forces with forces of motion, the former tending to produce conditions of stability, the latter conditions of instability. These forces undergo a ceaseless round of change, in which their form alone is altered, while their actual energy, whether it be kinetic or potential, remains the same; for the sum of the energy of the Universe is a constant quantity. Circular motion may become elliptic; elliptic motion may become rectilinear; molecules may possess individual motion, or they may move in groups, or they may be actuated by both motions simultaneously; or, again, they may be influenced in innumerable ways by contiguous molecules, which may lessen their motion in one direction and augment it in another, and may change its form, intensity, character, or duration; but, throughout all these changes, the actual initial amount of energy is present in some form or other. The changes are precise and definite, and they follow unvarying and immutable laws; does it not, therefore, appear reasonable that the Pythagoreans made the most prominent feature of their philosophy the belief that unity and law and an eternal harmony prevail in the affairs of nature?

In the foregoing lectures we have briefly considered one of the dominant motions of the Universe; and we have seen how it is generated, how it influences matter, and how it passes into other forms. From first to last, we cannot fail to have noticed that it is most inimical to rest; that it ever tends to convert a condition of rest into a condition of, at least, temporary unrest. Indeed, we are almost disposed to regard *it*—a motion of molecules—as a condensed form of the motion of masses, since we have learnt that an increase of warmth in a mass of matter too slight to be felt, truly represents a force competent to lift that same mass to a height of many hundred feet; and the old Parmenidean dogma that heat is the cause of all the motion in the Universe* appears more reasonable than ever before. Not only has heat become a science of kinetics, but physical science itself is daily becoming more kinetic in its character, and there can be no doubt that other of the so-called physical forces besides light and heat will, sooner or later, be resolved into forms of motion. I have before spoken of the physical philosophy of Descartes as, perhaps, the most comprehensive kinetic system which has appeared in the whole history of science; and I am often reminded that, in our treatment of certain branches of science (specially in that of heat), we follow closely in his footsteps; in fact, our modern physical philosophy may almost be called *Neo-Cartesianism*. It is much to be wished that we adopted the Cartesian metaphysics to the same extent, in place of the pernicious Positivism† which now prevails. The philosophic spirit of the age tends towards the establishment of a syncretism between the philosophy of matter and the philosophy of mind; and, while the former has scarcely been elevated by the means, the latter has undeniably been degraded and materialised. A moment's comparison with the Platonic philosophy will convince us of this. The Positivists would have us apply to both mental and physical philosophy the same laws and the same modes of treatment; they would have us believe that only which is capable of direct demonstration; they would make the intellect infallible, and the senses all but infallible, forgetting how utterly relative is all our knowledge, and how we necessarily judge of things more in relation to ourselves than in relation to the great Universe around us.‡

* Parmenides, of Elea, according to Aristotle, Diogenes Laertius, and others, propounded this idea. It was afterwards adopted by Telesius of Cosenza, and other Middle Age philosophers, and in a modified form by Descartes.

† A good account of the most modern phases of Positivism is given by Ravaisson in his "Philosophie en France au XIXieme. Siécle."

‡ The following extract from the treatise "De Sapientia Veterum" of Francis Bacon would appear to be peculiarly applicable to a certain sect of philosophers of our day. At the same time, we do not wish to give to the word *φιλόσοφον* the same significance as did some of the Greek Fathers—S. Chrysostom, for example, in his charmingly eloquent 'Ομιλια εις Ευτροπιον. Pentheus, it will be remembered, hid himself in a wood, in order to be a spectator of the hidden mysteries of a Bacchanalian revel, but, being perceived, he was smitten with a

It is a hard, unyielding philosophy, which weakens some of the finer attributes of our nature, and destroys faith; it is a philosophy which engenders intense intellectual pride, for it induces our finite intellect to place itself on a level with Infinite Intellect. Rather than this, I say, let us adopt the Cartesian philosophy, and take, as our first principle of certainty, *Cogito ergo sum.** "To think," says a learned divine of our day, "is to see the chain of facts in creation, and, passing along its golden links, to find the hand of God at the beginning, as we saw his handiwork in its course."† In this spirit did Descartes think; in this spirit did he propound the first proposition of his system—"Cogito ergo sum."

The path of pure and divine philosophy is rugged with mounds which men have raised from time to time in the hope of seeing further than their fellows—back into the past, forward into the future; and many of these contain within them the festering remains of dead philosophies, which the world has buried out of her sight for their very loathsomeness. Albeit travellers often ascend these lofty tombs, allured by the hope of getting a clearer view of the distant land they seek; and, when they reach the summit, they are wearied, the time is far spent, and, as the light of day fades from their eyes, and darkness obscures the road, they lie them down, and rest side by side with the corpse of the philosophy which has seduced them. Almost at the outset of our journey, we pass a neglected mound, upon which the traveller has long ceased to rest; and it bears, in nearly effaced characters, the names of Gorgias and Protagoras. Near it, we see a greater eminence, raised by Socrates, and augmented by Cynics, and Megarics, and Cyrenaics. A very mountain bears the name of Aristotle. Many such mounds we pass; some overgrown with underwood, from which peep the ruins of forgotten shrines; some covered with asphodels and cypresses, some with myrtles and with bays, while others, again, are mere morasses, dangerous to tread upon, and rife with disease. Such an one is seen in a misshapen mound, reeking with decay, and too loathsome to approach; the home of vultures, and of ghouls, and of unclean beasts; and it bears the names of Diderot, La Mettrie.‡ Somewhat near to this, we see an eminence which, although new, is gigantic in its proportions; it is the resort of innumerable travellers of every race and of every creed, and they help to raise it higher, for they would fain climb to heaven by its means; and upon it we read the name of Auguste Comte. But what graceful peak rears its head sublime above the plain? it pierces the very clouds; it is clothed with amaranths, and it bears upon its summit a fane dedicated to Immortality. Lo! the calm, the sovereign, the ineffable spirit of Plato dwells therein. Here, as *we* travel along the path of philosophy, let us rest; here let us throw down our burden of modern Positivism, and then start afresh, Platonised in spirit and in thought.

kind of frenzy, one result of which was that he saw everything double and thus vacillated between the unreal and the real. A detail account of his doings is given both by Euripides and by Ovid, and the force of the following passage will be scarcely realised unless the reader be familiar with one or other of these accounts. "Alia est Penthei calamitas. Qui enim ausu temerario, mortalitatis parum memores per excelsa Naturæ et Philosophiæ fastigia (tanquam arbore conscensa) ad mysteria divina adspirant, iis pœna proposita est, perpetuæ inconstantiæ, et judicii vacillantis, et perplexi. Cum enim aliud sit lumen Naturæ, aliud Divinum; ita cum illis sic, ac si duos Soles viderent. Cumque actiones vitæ et decreta voluntatis ab intellectu pendeant: sequitur etiam ut non minus voluntate, quam opinione hæsitent nec sibi omnino constent: Itaque et duas Thebas similiter vident. Per Thebas enim actionum fines describuntur (cum Thebis Pentheo esset domus et perfugium). Hinc fit, ut nesciant, quo se vertant, sed de summa rerum inc erti et fluctuantes, tantum subitis mentis impulsibus in singulis circumagantur."

* "Sic autem regicientes illa omnia, de quibus aliquo modo possumus dubitare, ac etiam falsa esse fingentes; facilè quidem supponimus nullum esse Deum, nullum cœlum, nulla corpora; nosque etiam ipsos non habere manus, nec pedes, nec denique ullum corpus; non autem ideo nos qui talia cogitamus nihil esse: repugnat enim, ut putemus id quod cogitat, eo ipso tempore quo cogitat, non existere. Ac projinide hæc cognitio, *Ego cogito, ergo sum*, est omnium prima et certissima, quæ cuilibet ordine philosophanti occurrat."—*Principia Philosophiæ*, lib. i., p. 7.

† "The Limits of Philosophical Inquiry," an address delivered to the Members of the Edinburgh Philosophical Institution, on November 6th, 1868, by William, Lord Archbishop of York.

‡ The "Système de la Nature" of La Mettrie is one of the most vilely assumptive and irrational works which has appeared in the whole history of thought. Published during the most gross and rampant period of French materialism, it aimed at the destruction of ideas spiritual, ethical, and philosophical, which have ever been inseparable from the human mind; which have been cherished by races the most diverse in every age and every civilised country. Ideas which belong as much to Koung-fou-tæu, to Zoroaster, and to the Vedic Brahmans as to Plato, Socrates, and Seneca, or to the thinkers of our day.

PROCESS FOR DETERMINING THE CARBON CHEMICALLY COMBINED WITH IRON.*

By Professor EGGERTZ,
Director of School of Mines, Falun, Sweden.

When steel or pig-iron containing carbon in chemical combination is dissolved in nitric acid, a soluble brown colouring matter is formed whose colouring power is quite intense, and the solution assumes a tint which is dark in proportion to the quantity of the chemically-combined carbon.

Iron and graphite (or free carbon) do not influence this colouring; for the solution of nitrate of iron is colourless, or, at most, slightly greenish, unless extremely concentrated, and graphite is insoluble in nitric acid.

Thus, in dissolving two pieces of different steels of the same weight in nitric acid, taking care to dilute the darker solution until the two liquids present exactly the same colour, it is very evident that the more highly carburetted steel will furnish the larger quantity of liquid, and that the proportion of the volumes will indicate the relative proportion of colour in the two steels.

If now the composition and content of carbon of one of the steels is known, the absolute percentage of carbon in the other steel may be immediately deduced.

Suppose that 1 grm. of each of two steels (*a* and *b*) have been dissolved, and that the volumes of the two solutions brought to the same degree of colouring bear the relation to each other $a : b :: 5 : 7$. Knowing that the steel (*a*) contains 1 per cent carbon, you at once deduce that the steel (*b*) contains 1·4 per cent of carbon.

In applying this method of analysis, certain precautions must be taken, which we proceed briefly to point out.

In a cylindrical test-tube, dissolve gradually in the cold 10 centigrammes of wrought-iron, steel, or cast-iron reduced to a fine powder, in 1½ to 5 c.c. of nitric acid of 1·2 specific gravity (about 25° Baumé). The use of nitric acid containing hydrochloric acid must be avoided, because the solution of iron would have a yellow tint.

In proportion as the metal contains more carbon, more nitric acid must be used. After some time, when the chief part of the metal appears to be attacked, place the tube in a water-bath to the depth of about 15 m.m., and warm it to 80° C. In this position, only the lower part of the tube is in contact with the warm water; a movement takes place in the acid which favours its reaction upon the metal; a slight disengagement of carbonic acid from all the particles of carbon may be observed. The operation should always be conducted under the same circumstances as to heat and length of time.

The evolution of gas having ceased (in operating upon steel, the reaction must continue two to three hours), place the tube in a large vase filled with water, to bring the solution always to the same temperature. This precaution is indispensable, because the same liquid is darker when warm than when cold. Afterward, pour off, as exactly as possible, the clear liquid into a graduated burette. Upon the black residue remaining in the tube, pour some drops of nitric acid, and heat carefully over a lamp. If there is no further liberation of gas, the residue

* From the *Bulletin of the Chemical Society of Paris*; translated for the *American Journal of Science* by J. Wharton, Esq.

consists of nothing but graphite or silica. Cool the new solution, and add it to that which is already in the burette.

The liquid is then diluted with water until its colour corresponds exactly with that of the normal liquid, which latter should be of such a degree of concentration that each cubic centimetre represents 0·0001 grm. of carbon.

If, for instance, this normal liquid is prepared from cast-steel containing exactly 0·85 of one per cent of carbon, 1 decigramme of that steel must be dissolved in 8·5 c.c. of nitric acid; 100 grms. of steel containing 85 centigrammes of carbon would thus be dissolved in 8500 c.c. of the normal solution, 100 c.c. of that solution would represent 1 centigramme of carbon, and, consequently, 1 c.c. of the normal solution would represent 0·0001 grm. of carbon.

The normal solution does not keep, and should be often renewed, since it becomes perceptibly paler even within twenty-four hours. For it, however, may be substituted a dilute alcoholic solution of sugar properly caramelised brought to exactly the same tint; this solution keeps much longer without sensible change.

As 1 grm. of iron cannot readily be dissolved in less than 15 c.c. of nitric acid, it follows that a proportion of carbon less than 0·15 of one per cent* cannot be estimated by means of the normal liquid; but this minimum is seldom found in practice.

If the proportion of carbon exceeds 0·5 of one per cent, the ferruginous solution is so concentrated that it has a light greenish tint, which renders its comparison with the normal liquid difficult. In that case, a normal liquid of one-third the strength is prepared by diluting the normal liquid with twice its volume of water; then each cubic centimetre of the liquid represents only one-third of the ten thousandth part of a gramme of carbon. When the proportion of carbon in the specimen to be analysed is very large (as, for instance, in white cast-iron), only 0·5 grm. of the metal must be taken for analysis, and, in that case, half a cubic centimetre of its solution corresponds to a cubic centimetre of the normal solution. If the metal to be analysed contains graphite, the latter must be collected on a filter before the solution is put into the burette.

This method is more exact in proportion as the percentage of carbon is smaller. With an accurate balance, and with suitable arrangements, a great number of determinations of carbon close enough for practice can be effected in a time relatively very short.

All the Bessemer steel made at Edskin, in Sweden is marked, after hammering (*apres l' étirage*), by figures expressing its hardness, as ascertained by this colour-measuring analysis of Professor Eggertz.

It is obvious that only burettes of perfectly colourless glass must be used, or, at least, they must all have exactly the same tint.

NOTICES OF BOOKS.

What is Matter? By an Inner Templar, Author of "More Light: a Dream in Science."

We are informed by his biographers that when the author of "The Raven" composed his extraordinary lecture on Cosmogony, he started by denying that the arcana of the universe can be explored by induction. He informed his imagination with the various results of science, and then "entered with unhesitating boldness, though with no guide but the divinest instinct, into the sea of speculation, and there built up of according laws and their phenomena, as under the influence of a scientific inspiration, his theory of nature."

But Poe, although a poet, was, in his lucid intervals, well aware of the difference between poetical speculation and hard scientific truth, and, with characteristic audacity and clearsightedness, dedicated his work "To those who feel, rather than to those who think." Poe's work was in perfect logical harmony with the rules he laid down for himself as a poet, and we therefore accept it. The work before us is in logical harmony with no laws human or divine, and we therefore reject it. When a man writes nonsense and, by publishing it, challenges criticism, it is our duty to consider whether, "though it be madness, there is method in it;" and we are forced to admit that there is method in the work before us—but not much.

When a man writes nonsense, we are also bound to consider the tone in which he writes it. If he offers us his views on the more difficult problems of the universe, and those views are obviously incorrect, still, if propounded modestly, and argued cleverly, we receive them for what they are worth, and are loth to handle their author too roughly. But the views of the author of "What is Matter?" are neither propounded modestly, nor argued cleverly, and we therefore do not feel bound to be specially lenient to him.

Doubtless the Inner Templar considers that to fairly review his book, we should analyse each chapter *seriatim* and disprove his arguments as they arise; this, however, is impossible. A long review of such a work would not only be unreadable but utterly useless, and we think that if we convict our author of want of modesty, of want of judgment, and of ignorance of the subject on which he writes, we have done as much as can be expected under the circumstances.

When a man feels that those problems which have puzzled the wisest of mankind are to him easy of solution, we can forgive him for being (for a short time) so elated as to be moved by a crowd of foolish impulses, and if, in addition, he finds that all physical phenomena, including the secret of the nature of matter, are to him as self-evident things, we can forgive him for believing himself the wisest of mankind. But, on the other hand, if we find him announcing almost incredible discoveries, as revelations from an angel, and describing the revealer and the manner of the revelation in language of that childishly pompous character which our American friends stigmatise as "high falutin," we begin to doubt whether such absolute want of judgment can co-exist with superhuman clearsightedness.

The first announcement of the work before us was contained in a pamphlet called "More Light," which we noticed a few weeks ago, and we feel bound, after again looking at it, to say that it was one of the silliest productions ever written; and yet *The Tablet* (we quote from the opinions of the press) considers itself bound to "do the writer the justice to say, that his brief narrative is pleasantly written, and constitutes a lively contribution to a class of works rarely attractive to any but scientific readers." We feel bound to do the writer of the notice in the *Tablet* the justice to say that the only redeeming point in his notice is the fact that he offers "no opinion as to the scientific value of this little treatise." In fact, it is most unpleasantly written, and constitutes anything but a lively contribution to a class of works rarely attractive to any readers whatever.

"What is Matter?" is a neat little octavo volume of 195 pages. It is excellently printed on good paper, and all rights are reserved.

The work is divided into three books, each of which is sub-divided into chapters, and there is a very complete table of contents.

The first book is principally devoted to a sketch of the opinions of the principal philosophers of antiquity, and we need not say that the continual repetition of such names as Thales, Anaximenes, Diogenes, Heraclitus, Anaxagoras, Zenophanes, Pythagoras, Empedocles, Leucippus, Socrates, Plato, Aristotle, Epicurus, Zeno., &c., &c.,

* O. D. Allen, of the Freedom Iron Works, Pennsylvania, has found it quite practicable, by a modification of this method, to distinguish between irons containing respectively 0·10 and 0·15 of one per cent of carbon.

gives an air of dignity to the work which we hasten to acknowledge.

In Chapter VII. we come to a discussion on the views of Faraday, and Dr. Daubeny is severely handled for deficiency of imagination, and prejudice, and we are told that "It is painful to notice how he clings to existing notions, and appeals to common sense." We shall show further on that the last mentioned fault of the lamented Professor is one which can never be justly urged against our Inner Templar. Our author is not nearly so dogmatic upon some of the questions he discusses as might be expected from the favoured pupil of Oriel (see "More Light" *passim.*) In examining the question as to whether interplanetary space is on vacuum or a plenum, Sir John Herschel is quoted as of opinion that the sun is in a continually excited electrical state, which may account for the tails of comets being always directed away from the sun. "But" says our author "this loses a great deal of its force, as that which produces the plenum is ether; but when a vacuum is produced by experiment, it is always supposed that the vacuum is a plenum so far as the ether is concerned, for no pump has ever been constructed which touched that point, and, in fact, if the vacuum be not a plenum of ether, what becomes of the undulatory theory, for light passes through a vacuum, as is very clear, or we should not be able to see a light on the other side of the receiver, and it must on that theory have ether to be set in vibration. And if we suppose the vacuum to be a plenum of ether when the air is removed, we have had two plena occupying the same space, which, surely, is not orthodox; and if it be argued that the ether was hidden in the pores of the air, how is it that this ether continued to stay behind when the air was driven out? If, then, every vacuum must be a plenum of ether, as the undulatory theory requires, and electricity will not pass through such a vacuum; it seems clear that light and electricity differ greatly, for it appears that electricity requires *ordinary* matter for its medium, but light not. May not, then, electricity be regarded as a sublimating of ordinary matter, and light such matter sublimated? for electricity produces light, but it does not appear that light must necessarily produce electricity. Altogether, what with plena, and vacua, and ether, the subject is in as highly organised a state of confusion as the bitterest opponent of the undulatory theory could wish for."

We have made this long quotation solely that it may not be said that we have condemned a book without sufficient reason. Is it too much to say that the "highly organised confusion" is in the bewildered brain of the Inner Templar? The query as to whether electricity may not be regarded as a sublimating of ordinary matter, and light as such matter sublimated is charming, and will, we trust, be put to "Oriel" at his next meeting with our author.

We must, absolutely, make one more quotation. Our author, speaking of a ray of light proceeding from the sun, says, "Such a ray, I conceive, consists of a continuous stream of atoms travelling with different velocities, and at the same time revolving with different velocities upon axes at right angles to their line of projection. These particles are but ultimate atoms of the different forms of matter existing in our solar system, and, though so minute as to be beyond all power of weight, have, I doubt not, a considerable influence in renewing the energy which is being continually expended by our globe. This incessant pouring of millions upon millions of ultimate particles of the elements into our atmosphere, and into even the solid body of the earth, must, I think, greatly assist in explaining not only the almost universal presence of sodium —doubtless the chief cause of the yellow rays of the sun— but the presence of many other forms of matter which exist to such an extent in the atmosphere that it has been remarked that, in a cubic yard of air, might be traced the presence of almost every elementary substance. And, again, in regard to the ocean, which occupies three-fourths of the surface of our globe, who can say that the floods of light poured into its depths ages ago, when the sun's power must have been much greater, not to mention its present influence, may not have had a great effect upon its constitution—we know how its temperature is affected—and greatly contributed to the presence of those metals—especially sodium—which are a part of its constitution?" When we remember that, in "More Light," our author distinctly asserts the original matter to be nothing revolving upon an axis, that he also, in this work, states that he regards light to consist of the ultimate atoms revolving upon axes, and that these atoms are beyond the power of weight because they are so small, and that the sodium in the sea is derived from the sun's rays, we think we have proved to every reasonable person that our author is devoid of judgment in general, and that he is ignorant of the subject upon which he writes. As regards his modesty, let us quote one more paragraph from the author's "conclusion." "I have not hesitated to take the heterogeneous mass of materials supplied by every eminent man from Thales to Kant, and out of it to construct an edifice which, harmonising in all its parts, will, I trust, defy all the insidious workings of time with all the power that either talent can produce or ingenuity afford; but it is to the labours of Snellius, Newton, Faraday, and other great workers in the scientific world, that I am chiefly indebted." We ask our readers if this is not without a parallel in scientific literature?

In conclusion, there is internal evidence in "More Light" and "What is Matter?" to show that the author is a very young man. He has read much, and is by no means devoid of enthusiasm and a certain kind of cleverness. He is, however, unfortunately utterly devoid of modesty, and will, therefore, not accept advice. If he would, he might even now, perhaps, become a useful labourer in the field of science. Let him, instead of making a childish boast of never having made a single experiment, let him, we say, take up a physical or chemical question and experiment upon it earnestly and faithfully, and his mind will become disciplined, and, possibly, in his maturer years he may even acquire modesty. If he wishes to learn a great truth, let him experiment upon a subject which he has made all his own. Let him take pure water and see if, by passing the sun's rays through it, he can condense the chloride of sodium; if so, it is evident that, by the aid of "more light," he will obtain sea water. When he has condensed enough salt to be detectable by the spectroscope we will revise our review, retract our strictures, and unreservedly follow the Inner Templar as our guide, philosopher, and friend!

Revue Scientifique et Industrielle. Par EMILE KOPP, Professeur du Musée Royal et Industriel Italien à Turin. Extraits du *Courrier du Bas-Rhin.* Strasbourg: 1869.

IN this work—in which, (as somebody says) there is a thin rivulet of text meandering through a broad meadow of margin—we find nine articles, three of which, on "*Le Blanchissage Domestique*" we cordially recommend to the notice of housewives in general, and of all foreign nations —especially Sicily—in particular. Why M. Kopp has given this prominence to the subject we are at a loss to imagine unless he has fond recollections of *Blanchisseuses de fin*, and *Closerie de Lilas*. At all events, he has done good service, and shown an utter absence of pride by descending from the lofty heights of organic chemistry to the washing of linen; and what an astonishingly practical man he his! He treats of "*Inconvenients d'un trop riche Assortiment de Linge*," which, it must be confessed, few have discovered; he treats of *savonnage*, *rinçage*, *azurage*, *tordage*, and *sécharge*. We have found a frequent appeal to the dictionary necessary, and sometimes useless; let any of our readers tell us off-hand the English of *essangeage*: we had not the least idea that the French language was so rich in ablutory words, and we accept it as a happy omen. M. Kopp *must* become the hero of laundresses from his admirable ideas of economy; look here, for instance— "A la vérité le savon bien sec, surtout le bon savon de

Marseille, se dissout bien moins rapidement, et on realise ainsi une économie notable." Will some *bon savant* tell us all about "le bon savon de Marseille?"

The other articles treat of the "Anomalous Properties of Water," of "Meteorites," of "Explosive and Fulminating Substances," of "Fire Arms," of "Nitroglycerine," and of "Gun Cotton." They contain, for the most part, a good *resumé* of recent research in connection with each subject, and may be perused with advantage.

CORRESPONDENCE.

ROYAL SULPHUR SPRING, HARROGATE.

To the Editor of the Chemical News.

SIR,—In my communication on the above spring, published in your valuable journal of the 16th of July (CHEMICAL NEWS, vol. xx., p. 26), by some mishap I omitted the analysis; it is appended:—

Saline Ingredients in the Imperial Gallon.

	Grains.
Carbonate of lime	18·649
Carbonate of magnesia	1·783
Carbonate of baryta	0·291
Carbonate of strontia	trace
Chloride of sodium	538·180
Chloride of potassium	3·103
Chloride of calcium	32·327
Chloride of magnesium	27·872
Chloride of barium	0·494
Chloride of strontium	trace
Chloride of lithium	faint trace
Sulphide of sodium	9·135
Iodides, bromides, &c.	traces
Total grains per gallon	631·834

—I am, &c.,

SHERIDAN MUSPRATT, M.D.

College of Chemistry, Liverpool,
July 26, 1869.

OLEOGRAPHS.

To the Editor of the Chemical News.

SIR,—Having been from town, I have only to-day seen the CHEMICAL NEWS, and I beg you will allow me to reply briefly to Mr. Tomlinson's letter in reference to oleographs. Like every other new and valuable discovery, oleography is praised, and by others condemned. Oleography is yet in its infancy, and, just as a new and perfect process for the ultimate analysis of a complex organic substance cannot be devised in—it may be years, so we cannot expect perfection at once in this beautiful method for testing oils. I can assure Mr. Tomlinson that it is no fault of mine that he is pestered with numerous paragraphs from all varieties of journals condemning oleography. I never sent any article to one of them but the CHEMICAL NEWS on the subject, nor have I seen them. My opinion is yet the same that oleography is, in its present and very much improved state, an excellent conjunctive test for the purity of oils. No one can doubt for a moment, who has really worked at the subject carefully, that an oil figure on water can be transferred in an instant, perfectly uninjured, to paper. In the examination of trade oils, besides using oleography to assist me, I also employ the following among other tests:—

Appearance, gravity, taste, odour, rate of passage through narrow tubes, weak and strong solutions of potassic, sodic, and ammonic hydrates; shaking the oil, rise in temperature with hydric sulphate, boiling in alcohol, boiling point, burning in lamp, freezing point, passing chlorine, calcic hydrate, euchlorine, calcic hypochlorite, mercurous nitrate, hydric phosphate.

I trust Mr. Tomlinson is satisfied that I have no desire to associate his name with oleography further than to acknowledge that his name is intimately connected with cohesion figures. At many lectures I have given, here and elsewhere, in which I introduced oleography, I always took care to mention Mr. Tomlinson's name while referring to cohesion figures only. I perfectly agree with him in not wishing to describe oleography as having arrived at perfection. It is quite a young art yet; it has fulfilled all I have said, and it promises greater things.—I am, &c.,

R. CARTER MOFFAT.

Laboratory, Glasgow Mechanics' Institution,
August, 4th, 1869.

MISCELLANEOUS.

Hallogenin.—Under this name is sold in Germany a mixture of salts intended to prevent the formation of incrustations in steam-boilers. The mixture consists of 65 per cent of sal-ammoniac, 17 per cent of chloride of barium, and 18 per cent of catechu; it is said to answer its purpose very well.—*Deutsche Ind. Zeitung.*

Removal of Nitrate of Silver Stains from Woven Tissues.—According to M. Grimm, chloride of copper completely removes, even from coloured woven cotton tissues, stains occasioned by nitrate of silver; the tissue is to be afterwards washed with a solution of hyposulphite of soda, and next thoroughly washed with water. From white cotton and linen tissues, nitrate of silver stains are more readily and effectively removed by applying dilute solutions of permanganate of potassa and hydrochloric acid, followed by washing with hyposulphite of soda solution, and rinsing in plenty of fresh water. By these means the use of the highly poisonous cyanide of potassium is rendered unnecessary.—*Polyt. Notizblatt.*

Protection of Wood from Fire.—We learn from the *Deutsche Industrie Zeitung* of July 1, that at one of the collieries at Ibbenbüren, Westphalia, the woodwork is protected from fire by being painted with a mixture consisting of 5 parts of alum, 7 parts of rye-meal paste, and 30 parts of previously washed, *i.e.*, finely divided, clay (this mixture is used for woodwork not exposed to open air); for woodwork, so exposed, a mixture is used consisting of 2½ parts of crystallised sal-ammoniac, 1 part of white vitriol (commercial sulphate of zinc), 2 parts of joiners' glue, 20 parts of zinc-white, and 30 parts of water. These mixtures have been found to prevent wood bursting into flame on ignition, and to greatly delay its destruction even when severe fires are raging.

Thermoscope for Lecture Rooms.—Dr. A. W. Hofmann states that he frequently makes use of the following arrangement for the purpose of exhibiting, in a ready manner, the evolution of heat which takes place in chemical combinations and decompositions.—Some ether is poured into a tall test tube, and this tube is placed, for instance, in a recently-made mixture of sulphuric acid and water, the ether begins to boil, and its vapour may be ignited; in order to regulate the boiling of the ether it is best to place in it a platinum wire spiral. When, in a beaker glass, some sulphuric acid is first poured, and next, carefully on the top thereof, a layer of water, and these fluids are suddenly mixed by stirring the same with the ether tube, a flame of half a metre length may be suddenly evolved from the tube. The author has frequently applied this contrivance to exhibit the disengagement of heat on the sudden solidification of saturated solution of acetate of soda.—*Berichte der Deutsche Chem. Ges. zu Berlin.*

[This device was frequently adopted by Faraday during his Christmas Lectures.—*Ed.* C.N.]

Application of Leichtenberg's Experiment to the Mineralogical Analysis of Rocks.—M. S. Meunier proposes to make use of the well-known experiment of Leichtenberg's electric figures to separate from each other the divers mineralogical constituents of some kinds of rock. We briefly remind our readers that the experiment alluded to consists in charging with electricity a cake of resin or sealing-wax, by means of a previously-charged Leyden jar; it is thus possible to charge certain portions of the cake with positive, others with negative, electricity. In order to exhibit this to sight it is usual to blow, by means of a small pair of bellows, on to the cake of resin, a mixture of very finely-powdered red lead and sulphur; the friction, on leaving the nozzle, causes the powders to become electrified, and the sulphur being negatively electric is attracted by the curved figures positively electric on the cake, while the red lead follows the opposite course. M. Meunier has tried thus to separate sulphur-bearing trachite into its mineral constituents, and succeeded perfectly in getting the sulphide and feldspar from each other; he states that he has equally well succeeded with rocks made up of two different silicates.—*Cosmos.*

Analysis of Polcura.—Under the name of polcura there has been lately brought from St. Jago de Chili a mineral, met with, at a height of from 12,000 to 14,000 feet above sea level, in the Cordilleras de los Andes, imbedded between porphyry and melaphyr; this mineral exhibits a dirty yellow-coloured grainy somewhat crystalline mass; is acid and astringent to the taste; heated to 120° C., it loses 13·560 per cent of water. 24·184 per cent of the substance is soluble in boiling water;

from the portion insoluble in that fluid, equal to 62·251 per cent, hydrochloric acid dissolves 12·351 per cent, while the remaining 49·900 per cent is silica. The portion soluble in water yielded, on being quantitatively analysed, results as follows:—Sulphate of potassa, 2·5 per cent; sulphate of soda, 2·7; sulphate of lime, 26·1; sulphate of magnesia, 16·1; sulphate of alumina, 40·2; persulphate of iron, 4·6; chloride of sodium, 0·4; and soluble silica, 7·4. The portion insoluble in water, 62·251 per cent, consists of the following substances:—Alumina, 2·007; peroxide of iron and trace of manganese, 6·700; sulphuric acid, 3·330; silica, 49·900; and water, 13·560. The polcura is applied, in the country where it is found, to the tawing of the skins of sheep, goats, and calves; from the composition of its constituents soluble in water it will be readily seen that it is eminently fit to serve this purpose.—*Dingl. Polyt. Journ.*

Bubbles of Mercury Floating on Water.—When the lecture room of a chemical laboratory is provided with a sufficient supply of water under strong pressure, it is possible to make, and exhibit there, an experiment which, owing to a deficient pressure of water in such rooms, has been almost unnoticed. The experiment is the following:—Under an ordinary water-tap, the opening of which has from 10 to 12 m.m. diameter, a large-sized porcelain basin is placed, containing from 15 to 20 kilos. of mercury; the water-tap being suddenly opened, a strong flow of water is caused to fall into the basin at a height of from 8 to 10 centimetres from its bottom. On turning off the flow of water again, it will be seen that on the surface of that fluid there float about bubbles of mercury, usually exhibiting a diameter of only 1 centimetre, but occasionally some are found of two or three times that size. As a rule these bubbles are very ephemeral; now and then, however, it happens that some may be caught, along with a quantity of water, in a small beaker glass, and, on the mercurial bubbles bursting, it will be seen how very small a quantity of mercury these bubbles consist of. Professor Hofmann mentions that he saw this experiment first exhibited in the lecture room of the Royal College of Chemistry, London, when, some twenty years ago, Professor Melsens, from Bruxelles, was on a visit there. The pressure of water at the lecture room just named is from 10 to 12 metres; in the new laboratory of Berlin University the pressure of the water circulating in the tubes and pipes is from 20 to 25 metres.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, vol. lxix., No. 2, July 12, 1869.

This number opens with a brief notice of the death of Prof. Bérard, at Montpellier, already recorded in our paper; but we meet here with the following particulars, which are of general interest:—The father of the deceased was associated with the celebrated Chaptal, in the business of an extensive chemical factory, yet in existence near Montpellier, where the manufacture of sulphuric acid was first started on the continuous principle, and whereby has been effected the cheap production of that acid, and, by its means, of almost all chemicals. The deceased Dean of the medical faculty established in the city just alluded to, had been, since 1819, one of the corresponding members of the scientific body which now is the Académie des Sciences, but which in 1819 was l'Académie, an institution of very ancient date. A very great portion of this number is again devoted to the rather barren controversy about some letters and papers, purporting to be written by men who died some 150 years ago at the least. Among the papers and communications, we notice:—

Researches on the Products of the Alcoholic Fermentation of Beet-Root Juice.—MM. Pierre and Puchot.—The authors state that they have obtained from that juice, after alcoholic fermentation—(1) vinic aldehyde, ready formed; (2) vinic alcohol; (3) propylic alcohol; (4) butylic alcohol; (5) amylic alcohol. The authors devote this paper more especially to the study of the propylic alcohol, which they say boils, in its normal state, at 98°, while its sp. gr. at 0° is 0·820; its volume at 0° being taken as equal to 1000, it becomes 1115 at 98°, at which temperature its sp. gr. is 0·735. The authors further state that, theoretically speaking, propylic alcohol can be directly formed from sugar, by simply fixation of water and elimination of carbonic acid.

New Researches on the Properties of Explosive Compounds. Mr. Abel.—The contents of this abstract, which is published in this number at the express desire of the members of the Institute, are already well known to our readers.

Compressibility of Gases at High Temperatures.—M. Blaserna.—The author first refers in this paper to a series of researches made by him on this subject in former years, and published by him in the *Annales de Chimie et de Physique*. He next calls attention to a series of researches on this very same subject recently made by M. Amagat, which confirm both the author's researches and those made long ago by M. Victor Regnault. The author next passes to researches on the motion of gases, which, however, is a mathematico-physical paper, and not suitable for condensation in our columns.

Researches on Sulphur.—M. Chevrier.—The author has studied the action of vapour of sulphur on oxygen, hydrogen, nitrogen, protoxide and deutoxide of nitrogen, carbonic oxide, and carbonic acid. Vapour of sulphur and oxygen gas form a slightly explosive mixture under some conditions, but usually the vapour of sulphur burns off quietly, forming sulphurous acid. Hydrogen and vapour of sulphur yield sulphuretted hydrogen gas very readily and abundantly. With vapour of sulphur and nitrogen the author found no action at all. Vapour of sulphur and the two oxides of nitrogen just alluded to form, in the first place, sulphurous acid; nitrogen is set free, and if a frigorific mixture be applied to the apparatus containing the mixed gases and vapours, large so-called lead-chamber crystals are obtained. Oxide of carbon yields, with vapour of sulphur, oxysulphide of carbon. Carbonic acid and vapour of sulphur, exposed to the discharges of electric sparks, yield oxysulphide of carbon and sulphurous acid. The author of this paper adds a short notice on an—

Improvement of the Preparation of Carbonic Oxide.—When the gas just alluded to is evolved from a mixture of oxalic and sulphuric acids, as is well known, a mixture of carbonic acid and carbonic oxide gases is obtained. This mixture of gases the author causes to pass through a tube made red-hot in a suitable furnace and filled with charcoal previously well re-burnt; and, after having washed the gas through a solution of potassa, and also lime-water, he thus obtains a bulk of the pure carbonic oxide gas three times larger than would be the case if the carbonic acid simultaneously formed were not decomposed by the red-hot charcoal, which must be free from yielding any carburetted hydrogen gases.

No. 3, July 19, 1869.

This number contains the following papers, the contents of which belong to chemistry and sciences allied therewith:—

Explosive Properties of Chloride of Nitrogen and its Propulsive Force.—MM. St. Claire-Deville and P. Hautefeuille.—Chloride of nitrogen was discovered in the year 1812, by M. Dulong; It is the most unstable compound we are acquainted with, exploding most violently by very slight causes. The authors have, however, succeeded—and record in this memoir the means applied for this purpose—to estimate and measure with accuracy the force exerted by this substance when it changes its liquid for a gaseous state of aggregation. This they have effected by estimating exactly the quantity of caloric units which are set free at the moment of the explosion of the chloride of nitrogen; this quantity amounts to 38,700. The temperature of the gases, when the explosion takes place in closed vessels, amounts to 2128°, and the pressure of the gases is then equal to 3500 atmospheres, or equal to a pressure of 52,500 English lbs. to the square inch.

Spectrum Observations of Small Stars.—Rev. Father Secchi, S.J.—In a letter dated from Rome, July 13th, the eminent astronomer states that he has succeeded in studying the spectra of stars which are only of the 8th and 9th magnitude. The light emitted by such stars being very feeble, it is gratifying to learn that observation has proved that, among the spectral lines, those of carbon occur, and that the spectra, as seen, appear to prove a common origin for these small stars which are, comparatively, situated near to each other.

On Jacobsite, a New Mineral.—M. A. Damour.—This mineral owes its name to the fact that it has been found at Jakobsburg, in Nordmark, province of Wermland, Sweden. It exhibits regular octahedral crystalline shape; its colour is dark, with a metallic lustre; when pulverised, its colour is blackish brown; it scratches glass; its sp. gr. is 4·75 at 16°; it is attracted by the magnetic needle; is infusible before blowpipe flame, and loses no weight when strongly ignited in a platinum crucible; fuses readily to a bead with borax and phosphor-salt, yielding a yellowish green coloured glass; is insoluble in nitric acid, but slowly, yet completely dissolved by hydrochloric acid, while, at the same time, chlorine gas is given off. This mineral consists, in 100 parts, of:—Peroxide of iron, 68·25; protoxide of manganese, 20·57; peroxide of manganese, 4·21; magnesia, 6·41; and traces of oxide of zinc.

New Process for Obtaining Iron from its Ores.—M. Ponsard.—The author of this paper has applied Siemens's furnace to the manufacture of iron; he states that he has succeeded in producing 1 ton of cast-iron of excellent quality with a consumption of only 1 ton of fuel. The author summarises his results in the following manner:—(1) A great saving of fuel can be made, and iron obtained from its ores, without the use of blast furnace; (2) that, since the heat produced by flame is sufficient to effect all the chemical reactions and melt the metal, there may be used all kinds of fuel which produce gas—that is to say, all kinds of coal no matter whatever their quality, wood, lignite, peat, hydrogen gas, and mineral oils; (3) it is possible to obtain, at will, a more or less carburetted metal, according to the quantity of carbonaceous matter which is mixed with the ore and placed in the crucibles to act as chemical agent only. Specimens of iron of very good quality, obtained by the process as carried on by

the author, were exhibited to the members of the Academy at this meeting.

Magnetic Oxide of Iron and its Salts.—M. Lefort.—The author first reviews some experiments made by him on this subject so far back as the year 1852; he next states that, as a result from these researches, he had found that it was possible to obtain perfectly soluble and well-crystallised salts, which prove that the so-called magnetic oxide of iron (proto-sesqui-oxide) is capable of forming salts. The author prepares the proto-sesqui-oxide by precipitating, by means of caustic potassa, a solution containing a ferrous-ferric salt. The reason why preference is given to potassa is, that an oxide is obtained which is less readily affected by air, and more stable. This oxide, $FeO+Fe_2O_3+HO$, yields, after having dissolved in hydrochloric acid, and on being left to crystallise while standing over sulphuric acid, a crystalline mass made up according to the formula—

$$ClFe+Cl_3Fe_2+18HO.$$

The author has also obtained a sulphate of the following composition:—

$$SO_3FeO+3(SO_3),Fe_2O_3+2SO_3+15HO;$$

this salt, and in fact all the salts the magnetic oxide is capable of forming, are decomposed by heat far below the boiling-point of water.

Electricity.—M. Tourdes.—This is a short paper on a curious case of death by lightning, which took place on the 13th inst., at Kehl Bridge, near Strasbourg. The curious point is, that while quite close to the spot where three soldiers were seated under a rather low chestnut tree, two of whom were killed, while the third was rendered insensible and temporarily partly paralysed, there is a building provided with lightning conductors, and near, also, a very large iron railway bridge; yet the tree was struck, and the men seated under it on a bench killed, notwithstanding large masses of metal and excellent conductors of electricity were, at a far greater elevation, at hand for the electric fluid to run along. The author's opinion is that the metal buttons, and other ornaments made of metal, on the soldiers' dresses were the cause of their death by lightning.

New Acid from Sulphur.—M. Schützenberger.—While at a future date we may give a fuller account of the interesting facts contained in this rather lengthy memoir, we now confine ourselves to stating that the author has succeeded in forming a compound made up of a double atom of sulphurous acid, wherein 1 atom of oxygen is replaced by 1 atom of hydrogen; this free and anhydrous acid should be represented by S_4O_5H. The author has proposed to name this substance hydrosulphurous acid; some of its salts have been prepared by the author and obtained in crystalline state; the free acid is a very unstable compound, exerting strong reducing action.

Crystallisation of Metallic Oxides.—M. Sidot.—In this paper, the author records a series of experiments made by him in order to obtain artificially crystallised metallic oxides, starting from the well-known fact that most native oxides and sulphurets exhibit a crystalline form. The author has been occupied in researches with the view to obtain these forms by artificial means, and has succeeded, in many instances, by simply submitting some oxides—for instance, the peroxide of iron—to long-continued and strong heat. By this means, the said peroxide loses a portion of its oxygen, magnetic oxide is formed and simultaneously obtained in a crystalline shape: the sesquioxide of manganese, the oxides of cadmium and zinc, have also been obtained in distinctly crystalline state, by various manipulations and the application of suitable very high degrees of temperature.

Acetic Fermentation of Methylic Alcohol.—M. Béchamp.—The author states that on the 5th of September, 1868, he introduced into a vessel which could be properly closed, a mixture of methylic alcohol, pulp of sheep's liver, chalk, and water; and on the 15th of June last he opened the vessel and proceeded to test its contents, which he found to consist chiefly of acetic acid and non-decomposed methylic alcohol. His object was to ascertain whether methylic alcohol yields, under these conditions, any higher oxidised compound than acetic acid, which is ascertained to be the ultimate term of oxidation under the influence of the ferments used.

Journal für Praktische Chemie, No. 8, 1869.

This paper contains the following original papers and essays:—

Isomerism of the Derivatives from Naphthaline.—M. L. Schæffler.—This paper treats on naphthols, $C_{10}H_7.OH$, distinguishing—α naphthol, $C_{10}H_8O$; β naphthol; naphtholates; naphthol-ethyl ether, $C_{10}H_7OC_4H_5$; distinguished again into α and β. The paper is written with the view of proving that the isomerism of each class of bodies derived from naphthaline is a persistent character thereof; the paper is, however, too lengthy for further condensation.

Protein compounds met with in Zea-Maise, Indian Corn.—M. Ritthausen.—The author first reviews the labours of MM. Gorham, Bizio, Berzelius, and Stepf on this subject; and next states that he applied, for his researches, several varieties of maise grown in the botanic garden of Bonn University, at Poppelsdorf. The author obtained a substance which he names fibrine of Indian corn, and which contains, in 100 parts:—C, 54·66; H, 7·45; N, 15·50; S, 0·69; O, 21·70. This substance is insoluble in water, and soluble in alcohol and very weak alkaline solutions.

Alloy of Zinc and Iron.—M. Bayer.—The material here described was accidentally obtained at a Belgian iron smelting works, among a job lot of old iron. The alloy was of a very bright metallic and crystalline appearance, very brittle, so that it could be readily reduced to powder; sp. gr., 7·485; nearly entirely soluble, without residue, in dilute sulphuric and hydrochloric acids. Composition, in 100 parts:—Zinc, 83·66; iron, 13·00; lead, 2·70; tin, 0·05; insoluble residue, carbonaceous matter, 0·20.

No. 9, 1869.

This number opens with a list of the—

Symbols and Equivalents of the Elements.

And further contains the following original papers:—

On a Double Sulphide of Iron and Potassium.—M. Preis.—In order to obtain this compound, five parts, by weight, of iron, five parts of carbonate of potassa, and one part of iron (in the state of *ferrum redactum hydrogenio*) are intimately mixed, and placed in a crucible, and submitted to a gradually-increasing heat, and kept for at least one hour at bright red heat. The substance thus obtained is a compound, containing, on an average, in 100 parts:—Sulphur, 39·90; iron, 35·34; potassium, 24·76. Empirical formula, KFe_2S_4; rational formula, $KS.Fe_2S_3$.

Protein compounds contained in Oats.—Dr. Kreusler.—After reviewing the labours of Messrs. Johnston, Norton, von Bibra, and others, on this subject, the author states that he found that alcohol of ordinary strength (80 per cent) extracted the protein compounds from coarsely-ground oatmeal completely. After purifying the substance so obtained, its composition, on submitting it to elementary analysis, was found to be, in 100 parts:—C, 52·59; H, 7·65; N, 17·71; S, 1·66; O, 20·39.

The remainder of the papers are not original, and have been already abstracted by us from the original sources from which they are taken.

Les Mondes, July 15, 1869.

Although the brief notice of the following subject does not exactly belong to the subject matter usually treated in our pages, we cannot refrain from noticing the—

Steam Boiler Furnace.—Invented by M. de Pindray.—The reverend and learned editor of this periodical devotes two pages to this very interesting subject, from which we abstract the following:—Two steam boilers, of the same size, and in every respect identical to each other, were fitted up—one upon M. de Pindray's plan, the other upon the system hitherto considered the best in France—and both submitted, under precisely identical conditions, to a trial, the fuel used being the Friokaisin coal, from the neighbourhood of Charleroy, Belgium. During the trial, which lasted fully four hours, the production of steam by the Pindray system amounted to 9·440 kilos. of steam for every kilo. of coal burned; by the other system, it amounted to a production of 8·001 kilos. of steam for every kilo. of coal consumed. The indicated horse-power was (the pressure on each boiler being rigorously kept up to 4½ atmospheres) for the Pindray boiler, 124; for the other, 81. The production of steam for every square metre of heating surface amounted, in the case of the Pindray system, to 40·460 kilos., in the other case to 28·530 kilos. While the boiler fitted up to compete with M. Pindray's system of fitting up was confessedly the best, yet the latter gained 16 per cent of economy of fuel, and 42 per cent more effective force. These few data may suffice here; a saving of fuel, and a better application of heat for the purposes of production of steam are of so manifestly great interest, that we think we need not apologise for thus briefly entering for a moment on the domain of steam-boiler and furnace engineering.

July 22, 1869.

We notice from this number the following subjects:—

Wood Engraving by means of an Acid Composition.—M. Dulaurier.—The author states that, by some observations made by him previously, he was induced to try a mixture composed of sulphuric acid, several chromates, and persulphate of iron, to bite away some portions of wood upon which, after having first covered its surface with an asphalte varnish, which protects from the action of the acid composition those parts from which this varnish is not afterwards removed by an engraver's tool, he had engraved his name. This experiment, the author states, succeeded so well that very shortly wood engraving may become a greatly-improved manipulation, by means of the assistance of the biting action of acids. Unfortunately, the author neither states what kind of wood he used, nor also the precise composition of the acid mixture he has applied.

From the *accuse's de réception* of this periodical, we learn that the fifth part of the third volume of the *Archives Néerlandaises des Sciences Exactes et Naturelles*, by Dr. E. H. von Baumhauer, contains:—

Chemical Researches on the Poisonous Principle of the Root of the Cicuta Virosa.—M. Van Ankum.—This principle is an essential oil belonging to the camphine series, and is composed according to the formula $C_{10}H_{16}$; it exhibits rotatory power to the right. The root does not, according to this author, contain any alkaloid at all, either fixed or volatile.

Improved Stove and Chimney.—M. Ch. Joly.—The author states that, as a rule, the millions of chimneys applied in dwelling-houses are so badly constructed that, at the least, the useful caloric effect of the fuel is only from 5 to 10 per cent. In Paris alone, 500,000 cubic metres of wood are annually burnt, exclusive of coke and coals consumed for domestic purposes. The author has invented a combination of stove and chimney well worthy of imitation, and brought into use everywhere. His invention is based on sound principles; but, unless we reproduce the woodcuts annexed to the original, we could not make this matter well understood.

Manufacture of Chocolate.—M. Tresca.—Although this matter appears very heterogeneous, and even trivial, we must not neglect to

say a few words on this subject, taken from the ably-written report made by the gentleman just named, on the chocolate mills and factory belonging to M. Menier, situated at Noisiel. The proprietor, well known by name, also, in this country, is the owner, also, of a large estate in Central America, entirely devoted to the cultivation of the cacao tree (*Theobroma cacao*), from which the nuts are obtained which serve for the manufacture of an article of diet which contains every element required for the due nourishment of the body. The factory at Noisiel employs 300 workpeople, and during the last ten months the quantity of chocolate made has amounted to 2,388,347 kilos. (fully 2388 tons); the quantity of tin-foil used for packing amounts to a value of 10,000 francs a month; and the duty paid by M. Menier alone to the French *douane* amounts, for cacao alone, to a sum of nearly one and a half millions of francs yearly, exclusive of the sugar duties. M. Tresca states that the article is prepared with great care as regards the production of a really first-class and genuine material.

Cosmos, July 24, 1869.

Native Copper in Belgium.—While some drainage works were being executed at Vielsalm, province of Liège, the workmen found, at no great depth under the surface, a piece of native copper weighing about 2 kilos., and partly hollow inside, exhibiting crystals. This discovery has led to further research, the result of which is the finding of some veins of malachite.

Meteoric Appearance.—M. E. Arnoult, the well-known editor of *l'Institut*, writes from Vendôme, Département de Loir et Cher, about 80 miles south-west of Paris, stating that on the 15th of July, at 8'45 p.m., there was seen there a very bright meteor, which moved slowly from east to north, at an angle of about 45° above the horizon; it emitted a yellowish white light, so strong as entirely to overpower the light of the moon in her first quarter; it disappeared, without any perceptible noise or sound, in a few seconds, giving off a large number of very brilliant sparks. Since the writer of this brief communication is a good and trustworthy observer, and since he learned afterwards that several other parties had recognised this meteor at about the same time, there can be no doubt about the fact that a peculiar appearance had been observed.

Geological Map.—We learn from this periodical that a very greatly improved and enlarged geological map of Central Europe has been prepared and edited by the well-known geologist, *emeritus* Director-General of Mines for Prussia, M. von Dechen. This new map is on a scale of 2,500,000ths, and embraces the whole of Germany, France, England, and adjacent countries. The same author has recently finished a large geological map, in 32 large sheets, of Rhenish Prussia and Westphalia, which may be considered as one of the best ever executed of the kind, and one of the finest specimens of chromo-lithography ever published. The price of these works being very moderate, will ensure them a largely-extended sale.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 10, June 12, 1869.

This is a double number of this periodical, containing, in the first place, a very interesting and lengthy account of a *soirée* given by the president of the Society, on the 15th of May last, at the chemical laboratory of Berlin University. Following the plan of the printed periodical, we quote, in the first place, the catalogue of the brilliant exhibition of objects of interest to the scientific party assembled; this catalogue is divided into three sections, comprising:—A. Exhibition of Chemical Preparations of High Scientific Interest.—(1) M. Baeyer, Berlin, "Preparations of Indol, honystone, preparations of mellithic acid;" (2) M. Darmstädter, Berlin, "Chlormethyl-isaethionate of sodium;" (3) M. H. Wichelhaus, Berlin, "β-binitronaphthalin and derivatives of naphthol;" (4) M. Frank, Stassfurt, "Collection of bromates and other bromine compounds;" (5) M. Grübe, Berlin, "Compounds of chinon and artificial alizarine;" (6) M. Ladenburg, Heidelberg, "Preparations of silicium;" (7) M. Liebreich, Berlin, "Protagon, neurin, oxyneurin, and salts thereof;" (8) M. Martius, Berlin, "Victoria yellow, and compounds of binitro-kresol;" (9) M. Oppenheim, Berlin, "Mentha-camphor and derivatives of propylen;" (10) M. Scheibler, Berlin, "Collection of divers kinds of sugar, and models of the crystalline form some of these exhibit;" (11) M. Wichelhaus, Berlin. "Bibromo-pyroracemic acid and naphthol." B. Exhibition of Drugs, and of Products of Chemical Works.—This catalogue is by far too lengthy for reproduction; moreover, a great many of the substances exhibited are, if not better, at least equally well manufactured in this country; we notice, however, the following rare substances manufactured on the large scale:—M. E. Jacobsen, Berlin, "Peroxide of hydrogen, made by a new and peculiar process." Among the extensive series of substances exhibited by MM. Lampe, Kaufmann, and Co., Berlin, we notice a collection of thirty different preparations of quinine; *ferrum dialysatum*; pure pepsin; a large collection of chemically pure essential oils, among which *oleum cajeputi*, *oleum calami*, *oleum neroli*, and a large number of others; a fine collection of rare kinds of opium, among these some of German cultivation. Dr. Marquart, Bonn, the owner of very extensive and eminently well-conducted chemical works, exhibited large quantities of ethyl-benzol, zinc-methyl (chemically pure), zinc-ethyl, ethyl-methylaniline, anhydrous sulphuric acid, anhydrous phosphoric acid, hydrochlorate of ethylamine, chloride of carbon, several distinct compounds of chlorine and phosphorus, aldehyde, carbonic acid ether, oxide of mesityl, and a number of similar rare compounds, all perfectly pure and fit for scientific research. M. Schering, operative chemist, Berlin, exhibited a group of crystals of re-sublimed iodine, 2 feet in diameter; several rare compounds of bromine with metals; chemically pure tannic and gallic acids; rare preparations of cadmium and mercury. C. Exhibition of Physical and Chemical Apparatus and Glass and Porcelain Ware.—This portion of the exhibition surpassed even the two former, not only for extent, but also for the exquisite novelty and finish and utility of the apparatus exhibited; we can only quote a couple out of the very many:—M. Elster, manufacturer of gas-meters, Berlin, exhibited a highly-sensitive photometer, and experimented with it during the evening in one of the rooms of the laboratory. M. Geissler, Berlin, exhibited his large mercurial air-pump, and showed experiments with it in the laboratory set apart for gas analysis.

We abstract the following from the speech of the President of the Society, Dr. A. W. Hofmann. After having welcomed his scientific guests, the Doctor first alluded to the fact that the laboratory wherein they met had not been opened in a more official manner, and a meeting held therein honoured by the presence of high and mighty officials and rulers of the empire; but, he said, it was far more agreeable to him to see assembled together, on the evening of the day upon which the finishing touch had been laid by the workpeople to this temple of science, men who would appreciate with him the importance of this achievement for the University of Berlin specially, and for the scientific world in general. The eminent speaker then entered into the history of the causes which so long delayed the building of really good laboratories at Berlin and Bonn, long after the four* other ancient universities of the Prussian empire, as it existed before the late conquests, had been amply provided with laboratories which were worthy of the advance of chemical science of the present day. The building of the Berlin laboratory, just finished though it has been in partial use for one year, occupies a space of 21'680 sq. ft. The building, of which, with the present number of the above-quoted periodical, three lithographic prints are given, exhibiting, respectively, its frontage and the plans of the ground-floor and first-floor, has cost 318,000 thalers (£47,700), which sum the Prussian Government has granted for the purpose. The speaker next commenced a lecture on divers scientific subjects, from which we quote the following:—

Increase of Weight During Combustion.—The main feature of this brief *exposé* is the description of an experiment. A small horse-shoe magnet is hung up at the beam of a balance sufficiently sensitive to turn with centigrammes; the poles of the magnet are immersed for a moment in the *limatura ferri* of the chemists' shops, and a beard of small particles of iron is caused to adhere to the poles; by means of proper weights placed on the scale-pan at the other end of the beam the equilibrium is restored. This having been done, the finely-divided iron is kindled, by approaching to it the flame of a Bunsen gas-burner, and continues to burn. While burning, it will be seen that the arm of the balance on which the magnet is suspended considerably deviates from the horizontal position, thus indicating an increase of weight on the side where the experiment is going on. This experiment succeeds best with a magnet of moderate dimensions; the horseshoe magnet applied in this instance weighed, without its armature, 210 grms., and can bear a load of 12'5 grms. of iron; when this is altogether converted in magnetic oxide, by combustion, the increase in weight will be about 4'7 grms.

Formation of Ferric Acid.—An intimate mixture is made of one part of *ferrum limatum*, and two parts of nitrate of potassa. The speaker said he took, of both together, usually from 20 to 30 grms.; these are heated in a small glass flask over a strong gas flame; the mixture soon becomes quite incandescent, emits, out of the mouth of the flask, a firework of sparks, and leaves, at last, a mass partly fused together with the glass of the flask, consisting of ferrate of potassium. After cooling, this mass is reduced to powder, and, being exhausted with water, yields a deep reddish violet coloured, nearly transparent solution. Unless great care be taken to let the mass become quite cold before any water is added, the operation is spoiled.

We regret we can only quote the titles of the following subjects briefly alluded to by the eminent lecturer, on account of the impossibility of properly giving any condensed review without reproducing the woodcuts annexed to the originals:—

Volumetrical Analysis of Hydrochloric Acid and Ammonia by means of Electrolysis.

Condensation of Hydrogen and Oxygen when forming Water-Gas (vapour of water at very high temperature).

Lecture-Room Analysis of Marsh Gas and Olefiant Gas.

Lecture-Room Eudiometer.

Equality of Volume of Oxygen, and of the Carbonic Acid and Sulphurous Acid obtained from it.

Oxidation of Ammonia.

Evolution of Oxygen from Nitric and Sulphuric Acids.

Experiments on Flame.

Lecture-Room Thermoscope.

Comparison of the Volume of Different Gases submitted to the same Changes of Temperature and Pressure.

Compression of Gases by means of the Pressure exercised by a Column of Mercury.

Liquefied Sulphurous Acid Gas.

Bubbles of Mercury Floating on Water.

Local Ventilation as Lecture-Room Experiment.—This last paper contains a brief *resumé* of the excellent mode of ventilation adopted in the lecture-room of the Berlin laboratory.

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* Prussia Proper has Universities at Breslau, Königsberg, Greifswald, Halle, Bonn, and Berlin; and, in addition, the universities of Göttingen, Marburg, formerly belonging to the Kingdom of Hanover and the Duchy of Hesse Cassel, are now Prussian Universities.

On the 24th of May last the Society held one of its ordinary meetings, at which the following papers were read and communications made:—

Behaviour of the Trichlorinated Acetic Acid Salts and of Chloral with the Animal Organism.—M. Liebreich.—This physiologico-chemical paper is partly an answer to the question the author put to himself—Whether, during the splitting-up of such chemicals, of which the physiological effects of the bodies they separately yield on being split up is well known, the splitting-up thereof in the animal organism itself brings on the same phenomena as if the component substances were individually administered to an animal? As far as the author's experiments go, they seem to prove that the splitting-up of substances as those experimented with and named in the heading to this paragraph, actually produce phenomena, from which it is just to infer that they are produced by products derived from the splitting-up of the substances experimented with.

Action of Sulphide of Carbon upon Oxamide and Acetamide.—M. Ladenburg.—The decomposition of oxamide sets in at 180°, and is not quite finished at 200°. In order to avoid explosions, the sealed tubes have to be opened after several hours' exposure to heat. Among the gases which escape on opening the tubes, oxysulphide of carbon is the chief, mixed, however, with some oxide of carbon and hydrosulphuric acid. The reaction may be represented by the following formula:—$C_2O_2N_2H_4 + CS_2 = CSNH.NH_4 + COS + CO$. As to the reaction of acetamide and sulphide of carbon, the author states—"I have never been able to get it satisfactorily ended; it begins below 200°, at 210° a strong disengagement of gas takes place, and at a higher temperature the tubes always exploded. The disengaged gases contain much H_2S, COS, and CO, also vapours of hydrocyanic acid, and combustible gases not absorbable by baryta-water and protochloride of copper. In the residue in the tube, only sulphocyanide of ammonium and acetamide were left.

Formulæ of Benzol.—M. Ladenburg.—It is impossible to give a proper abstract of this paper without reproducing the woodcuts representing certain mathematical figures essentially belonging to this paper.

Contribution to the History of the Salicyl Compounds.—M. Henry.—After referring to a series of experiments made by the author with the view of exhibiting the action of pentachloride of phosphorus upon salicylic-aldehyde, the author now communicates the results of his researches on the action of pentabromide of phosphorus upon salicylic aldehyde. This action, he says, although less violent than that of the pentachloride of phosphorus, is yet rather strong. On purifying, first with water, and afterwards with ether, the substance resulting from this reaction, he obtained monobromated salicylic aldehyde—

$$C_6H_3Br\begin{cases}OH\\CHO.\end{cases}$$

When two equivalents of pentabromide of phosphorus were made to act upon one equivalent of salicylic acid, a substance was obtained which, after having been purified by means of ether and alcohol, exhibited a crystalline appearance, fusing at about 165°, and subliming at between 150° and 155°; formula—

$$C_6H_3Br\begin{cases}HO\\COHO.\end{cases}$$

Salicylic acid methyl-ether is not acted upon in the cold by pentabromide of phosphorus, but, on heating, among a series of secondary products, a substance is obtained named monobromo-salicylic acid ether—

$$C_6H_3BrCO(CH_3)O.$$

It is a solid, fusing at between 36° and 38°, and boiling at about 266°; its alcoholic solution is coloured beautifully violet on addition of a few drops of an alcoholic solution of perchloride of iron.

Researches on some Ethereal Derivatives of Polyatomic Acids and Alcohols.—M. Henry.—Unless we were to fill about a column of our pages with formulæ only, the condensed reproduction of this paper would neither do credit to its author nor be of use to our readers; we therefore only quote the title.

Contribution to the Chemical History of Diallyl.—M. Henry.—This is a preliminary notice on diallyl, C_6H_{10}, from which we learn that diallyl readily combines with N_2O_4, yielding a solid mass of white crystals composed according to the formula $C_6H_{10}(NO_2)_2$. Diallyl also combines with hypochlorous acid, yielding a fluid heavier than water, formula—

$$C_6H_{10}\begin{cases}(OH)_2\\Cl_2.\end{cases}$$

On the Stilben Series.—M. Grimaux.—This paper, owing to the large number of formulæ necessarily belonging to it, is not well suited for abstraction.

Annalen der Physik und Chemie, von Poggendorff, No. 5, June 15, 1869.

This periodical contains the following original papers:—

Definition of the Course of the Boomerang.—Dr. E. O. Erdmann.—A purely mathematico-mechanical essay.

Researches on the Behaviour of Vapours as regards the Law of Mariotte.—Dr. H. Herwig.—A lengthy physico-mathematical monograph on this subject, not suited for abstraction.

Nature of the Liquids found Enclosed in certain Minerals.—MM. Vogelsang and Geissler.—The authors review, in this paper, first, the labours of Davy, Simmler, Brewster, and others on this subject, and next state that they have applied for their researches spectrum analysis and microscopic research. Without a reproduction of the engravings accompanying this paper, it would be impossible to make the apparatus, and the mode of action thereof, understood. It appears as chief result of the researches made by these authors, that liquefied carbonic acid and water are very commonly met with enclosed in various minerals.

Researches on the conditions Influencing the Evolution of Bubbles of Gas and Vapour, and on the Forces which thereby come into Play.—M. H. Schröder.—This paper is the first instalment of a lengthy essay on a rather intricate subject. Since the author intimates that he will give a condensed *resume* of the main results of his researches at the end of his essay, we prefer not to go into particulars just now.

Reduction of Accurately-Made Weights, and Determination of the Error of Absolute and Relative Weighing without Reduction.—Dr. K. L. Bauer.

Construction of Galvanoscopes which are Extremely Sensitive.—M. H. Weber.—These are purely mathematical papers.

Form and Constitution of the Puddling-Dross Crystals obtained at the Steel-Works, Hombourg-Haut, near St. Avold, Département de la Moselle.—M. Kosman.—After reviewing the labours of others on this subject, the author first enters into a lengthy and purely crystallographical description of the crystals alluded to in the title. The specific gravity of this material is 4·44, the colour of the powder bluish green. In 100 parts, the substance contains:—Metallic iron, 0·29; monosulphuret of iron, 1·43; phosphuret of iron, 3·31; peroxide of iron and sesquioxide of manganese, 5·99; Fe_2O_3, 4·79; protoxide of manganese,* 0·75; lime,* 1·16; phosphoric acid,* 1·48; silica, 24·04; protoxide of iron, 47·50; protoxide of manganese, 7·35; lime, 0·82; magnesia, 1·49.

Determination of Galvanic Resistance.—M. J. Sirks.—A mathematical paper.

Spectrum of the Aurora Borealis.—M. J. A. Angstrom.—This paper is taken from the author's work, highly spoken of by M. Poggendorff, "Researches sur le Spectre Solaire," 4to, Upsal, 1868, avec Atlas de Six planches. The light exhibited by the Aurora Borealis is almost monochromatic, and shows one single bright line to the left of well-known lines of the calcium group.

Fluorescent Liquids for Geissler's Tubes.—Dr. Seilhorst.—The researches of this author have brought to light the fact that a good deal of deception is practised by the makers of the tubes, who make inaccurate statements as to the nature of the fluids they contain. The author found that *tinctura rad. curcumæ* answers best for yellowish green, *tinctura sem. daturæ* for deep green, *tinctura guajaci* for deep blue, *tinctura ligni quassiæ* for bright blue, *tinctura corticis Æsculi* for bluish green, and petroleum for bright blue. The author could not obtain a red fluorescence; all the tinctures are alcoholic.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 198, June, 1869.

This periodical contains the following original papers:—

Report on the Chocolate Manufactory of M. Ménier, at Noisiel (Seine et Marne).—MM. Tresca and Duchesne.—This report has been already alluded to by us, abstracted from another paper.

Report on a Peculiar Process of Dyeing a Fast Grey.—M. Barreswil.—The author states that MM. Bretonnière and Co., at Laval (Mayenne), have introduced very successfully the use of proto-nitrate of mercury as a mordant; and they apply, as dye, a solution of sulphuret of potassium, using 1 kilo. of that salt to 18 kilos. of woven tissue, or yarn, dissolving the salt, of course, in a sufficient quantity of water. The colour thus produced is essentially due to the formation of sulphuret of mercury on and in the tissues; and, according to the author of this paper, the colour is fast, that is to say, not destroyed by washing with soap or alkaline lyes, and resisting acids, but destroyed by chlorine.

Purifying of Syrups and Molasses by means of the Osmogène.—M. de Luynes.—This paper describes the details of M. Dubrunfaut's method of refining coarse syrups and molasses, by an apparatus called osmogène; but, unless the engravings annexed to this paper were reproduced by us, it would be impossible to understand the description properly.

The remaining papers in this number are—The continuation of a lengthy paper on—

Electro-Magnetic and Magneto-Electric Apparatus for Medicinal Applications;

A continuation of a report—

On the Culture of Truffles;

And a paper relating to locomotive engines.

NOTES AND QUERIES.

Vacuol.—I have met frequently in recent Continental journals with the terms "vacuol" and "vacuolised," in reference to fungi or the cells of fungi. I cannot find these words in Watts's "Dictionary," or in any of the foreign scientific dictionaries. Can any of your readers tell me the meaning of these terms, and with whom they originated?—Carbon.

* The analyst considers that these three, equal to 3·39 per cent, are combined together according to the formula—

$$(3MnO,PO_5)+2(3CaO,PO_5).$$

THE CHEMICAL NEWS.

Vol. XX. No. 507.

ON THE

METHODS OF ANALYSIS

AND THE

COMPOSITION OF VARIOUS CHEMICAL MANUFACTURING PRODUCTS.

By M. GASTON TISSANDIER.

Our object in publishing these memoirs from the *Moniteur Scientifique* is to furnish manufacturers and manufacturing chemists with practical methods of analysing with rapidity and certainty the most important productions of commercial chemistry, and also to give an account of their composition. Special treatises are not wanting containing methods of estimating and separating substances which are subjects of investigation to chemists; but we know of the existence of no collection where the description of a process for analysing such and such a commercial product may be met with. It should be added that the methods here published are not original, and offer nothing in the way of novelty, but are employed by most chemical experts. All that we have done is to make a few trifling modifications in a small number of cases. The efficacy of these processes we can in all cases guarantee by the practice acquired by us three years ago in the *Laboratoire d'Essais et Analyses Chimiques de l'Union National*, where we have already performed more than three thousand experiments of all kinds.

I. On Crude Potashes.

Manufacture of Beet-Root Salts.—Almost all the salts of potash now manufactured are extracted from beet-root, the crude salts or potashes being made by calcining the residues of the evaporation of weak vinegars proceeding from the distillation of molasses. These vinegars were formerly evaporated in copper basins; but the acids developed by too active or imperfect fermentation, or thrown in to hasten decomposition, were found to attack the copper, which soon led to the substitution of wooden vats—an important change, which was first effected by M. Coupier. Not long afterwards, another important step was taken by M. Porion, of Vardrecques, who, in the manufacture of salts, evaporated the vinegar partly by the direct action of fire, and partly by the combustion of the charcoal which exists in the organic substance of the vinegar. The Porion stove, which is now almost universally employed, consists of a long vaulted chamber, having at one end from two to three reverberatory furnaces, and terminating in a chimney, near to which is the tap which turns on the vinegar. This chamber is traversed through its largest extent by a paddle shaft, which agitates the vinegar violently, and causes it to fall in showers into that part of the stove which is subject to the direct action of the flames from the reverberatory furnaces. When the vinegar subjected to this preliminary process is sufficiently evaporated, it is placed upon the sole of the furnaces, where, under the action of the fire and vigorous stirring, it soon assumes a pasty form; after which it quickly takes fire, and becomes itself a source of heat, by means of which fresh quantities of vinegar may be evaporated. Calcination being at an end, the salts are thrown upon the ground, and spread out upon a large space, where a final combustion occurs spontaneously.

The calcination of vinegar residues in the Porion stove requires great intelligence and practice on the part of the operators, on account of the difficulty as well as importance of seizing the proper moment for stopping the calcination. If this latter be carried too far, the potash will melt, thereby producing a substance difficult to lixiviate. The appearance of the melted potash is that of a very hard, close stone, of a light grey colour, veined with white, on concussion giving a dull sound. If, on the contrary, calcination be too soon arrested, the product is a pasty mass, which quickly cools and agglomerates, yielding brown and frothy lixiviums, difficult to treat in refining. The refined products which ensue are never white, but always of a greenish blue tinge, due to the presence of certain unoxidised or non-volatilised sulphides. The appearance of an imperfectly calcined salt is that of an earthy, brown, close substance, not very hard, tinged throughout with reddish tints, and veined with green and violet lines. If a salt of this kind be wetted, an evolution occurs of the characteristic odour of rotten eggs.

In the preparation of salts, it is most important to remove them from the furnace just at the proper time; and the duration of the calcination varies in accordance with the kind of beet-root employed; thus, when the residue under treatment is that made from Picardy beet-root, which is rich in carbonate of soda, the removal must take place sooner than with residue from the beet-root of Artois.

The disposition of the salts in the heaps where combustion takes place also requires careful superintendence; because, if a heap gets too hot, the potash will run; and if, on the other hand, the temperature does not rise enough, the potash will be imperfectly separated. Salts rich in carbonate of potash are heaped in beds from 30 to 50 centimetres thick; the poorer salts in beds of 2 metres thickness.

A well-made salt ought to present the appearance of a porous stone, very light, friable, and sonorous as pumice-stone; its prevailing colour should be greyish red. Salts contain alkaline carbonates, chlorides, sulphates, substances insoluble in water (charcoal and carbonate of lime); also small quantities of sulphates, and, accidentally, cyanides, sulphides, silicates, ammonia, &c.

Mode of Analysis.—The sample to be analysed should be pounded and sifted. About 30 grms. must be taken and finely pulverised in a porcelain mortar. 25 grms. of this impalpable powder are weighed off, and placed in a flask capable of holding 500 grms., and containing about 200 grms. of distilled water; it is then boiled for a quarter of an hour, and left to settle, that the insoluble substances may collect at the bottom of the vessel. The clear lixivium is decanted upon a filter placed on a measuring-glass, guaged to ½ litre. The insoluble substances are again treated with cold water, and so on, for three or four times. Lastly, the insoluble substances are thrown upon the filter, and washed with boiling water until the filtered lixivium occupies exactly the volume of ½ litre. This lixivium, when cool, is stirred until it becomes homogeneous, and divided, by means of a pipette, in the following way:—

1. Deduct 100 c.c. (corresponding with 5 grms. of salts), in order to obtain the alkalimetrical standard; these 100 c.c. must be transferred to a ½ litre flask.

2. Another 100 c.c. to be poured into a ½ litre glass, to estimate the sulphuric acid.

3. Fifty c.c. (equal to 2 grms., 5 decigrammes) of salts to be poured into a stoppered bottle of 250 c.c., to estimate the chlorine.

4. Ten c.c. (equal to 5 decigrammes) to be poured into a porcelain capsule of 200 c.c., to estimate the potassium.

Insoluble Substances.—These must be dried at 100°, removed from the filter, and weighed. By calcining them, and weighing the ashes, the proportion of charcoal and organic matter will be obtained by difference.

Determination of the Alkalimetrical Standard.—A standard liquid must first be prepared containing exactly 100 grms. of sulphuric acid per litre (SO_3HO). For the preparation of this liquid, we refer to chemical treatises, only remarking that it should be carefully tested before

use. This may be done either by taking as a standard perfectly dry and pure carbonate of soda, or by estimating the sulphuric acid contained by means of chloride of barium. A graduated alkalimetrical measure is filled with the liquid, which is poured, after the addition of a few drops of litmus solution, into the phial containing the 100 c.c. of lixivium or 5 grms. of salts. When the solution has become purple, it is boiled, in order to remove the carbonic acid, and then recovers its original blue colour. Fresh quantities of sulphuric acid are now added, and it is again boiled. This is repeated until the addition of another drop of standard liquid causes the solution to turn from blue to vinous red, and boiling fails to restore it to blue. By reading the number of divisions corresponding to the volume employed of standard liquid, the alkalimetric standard is obtained: thus, if 44 divisions, or 44 cubic demi-centimetres, are used, the standard will be 44°.

Estimation of Chlorine.—One of the best processes for estimating chlorine in potashes is the employment of a standard silver liquid and a solution of neutral chromate of potash. 47·886 grms. of fused nitrate of silver are first dissolved in distilled water, and then diluted so as to form a liquid 1 litre in quantity. 1 c.c. of this liquid will precipitate 1 centigramme of chlorine. Several cubic centimetres of a saturated solution of chromate of potash are poured into the flask containing 50 c.c. of saline lixivium; and the silver liquid is then added, drop by drop, by means of a measure graduated in tenths of cubic centimetres, until the lixivium, augmented by the chromate of potash, turns red. If 14 c.c. of silver liquid, or 140 divisions, be used, 2·5 grms. of the salts will be found to contain 14 centigrammes of chlorine, reckoned in the summary as chloride of potassium.

The chromate of potash may be dispensed with; in that case, the portion of lixivium in which the chlorine is to be estimated is acidulated by pure nitric acid; the standard silver liquid is poured immediately into it, and the precipitated chloride of silver collected at the bottom of the vessel by quick stirring. The exact quantity of silver necessary to precipitate all the chlorine is easily ascertained; and care must be taken to stir the precipitate whenever fresh drops of the silver liquid are introduced. With practice, this method will be found as quick and accurate as the preceding.

Estimation of Sulphuric Acid.—This may be effected by means of chloride of barium. The 100 c.c. of lixivium are acidulated with pure chlorhydric acid, and chloride of barium is added. The precipitated sulphate of baryta is allowed to settle for twelve hours, and need then only be collected on a filter, washed with boiling water, and weighed after desiccation and calcination.

Estimation of Potassium.—By means of bichloride of platinum, the potassium is deposited under the form of chloroplatinate of potash. The 100 c.c. of lixivium corresponding to the 5 centigrammes of salts are acidulated with pure chlorhydric acid; an excess of bichloride of platinum dissolved in water is added in the same capsule, and the whole is then evaporated almost to dryness in a water-bath; at the same time, it is very important not to desiccate the precipitate, which, when taken out of the water-bath, should be moistened with at least 1 c.c. of liquid. On attaining this point, it is washed by decantation with ethereal alcohol (4 volumes of alcohol at 40°, and 1 of ordinary sulphuric ether), and thrown upon a small filter. It is again washed upon the filter with a small quantity of ethereal alcohol, dried at 100° in the water-bath, carefully removed from the filter, and weighed in a sensitive balance. It answers to the formula $KCl,PtCl_2$, and the amount of potassium contained in it may be easily calculated. Some chemists do not filter the chloroplatinate of potassium, but wash it by decantation in a vessel of Bohemian glass, where it is evaporated, and dry it in the same vessel in the water-bath. The very light precipitating vessel is tared before the operation, and, by weighing it together with the contained precipitate, the difference obtained is the weight of the latter. In treatises on chemistry, the chloroplatinate of potash is generally recommended to be filtered on a tared double filter—an unnecessary precaution with the proportions here mentioned. When the quantity of salts employed is 5 decigrammes, the precipitate obtained always weighs about 1 grm.; and the amount of substances which adhere to the paper is quite insignificant. To effect this process under good conditions, the best plan is to use a standard solution of bichloride of platinum, in order to be certain beforehand of using neither a too weak nor too powerful reagent. The platinum may be dissolved in the state of sponge by means of aqua regia, in the proportion of 60 grms. per litre, and diluted with water after evaporation: 10 c.c. of this liquid will be required to estimate the potassium.

Moisture.—The moisture contained in a salt may be estimated by drying 5 grms. on a stove, heated to 120°, failing which a small closed tube may be used, into which 5 grms. of salts are placed, and dried over a jet of gas, the water condensed at the upper end of the tube being soaked up with a plug of filtering-paper. The tube is weighed empty, and again with the desiccated portion of the salt, and the difference given is the proportion of water.

Calculation of the Analysis.—The estimated chlorine is transformed into chloride of potassium, the sulphuric acid into sulphate of potash. The quantity of potassium contained in the chloride and sulphate is calculated, and then deducted from the total of potassium yielded by the chloroplatinate. The excess of potassium is transformed into carbonate of potash. The standard corresponding with the carbonate of potash is calculated, and subtracted from the total standard, and the excess of the standard is transformed into carbonate of soda. The form of the analysis is drawn up in the manner indicated below.

Phosphates are sometimes contained in salts, but in small quantities, and, in analyses for purposes of manufacture, it is generally useless to pay any attention to them.

The mode of analysis here described gives very precise results; and, when practice has been acquired, the separation of potassium and sodium occurs with great exactitude. It has been proposed to separate the potassium by means of tartaric acid; but we believe that this process would be neither so practical, nor so rigorously exact as the one we have described, whilst with the *natrometer* its results would be merely approximative.

In the course of three years, more than 1000 specimens of salts and refined potashes have been analysed by us, an example of which we subjoin below.

COMPOSITION OF BEET-ROOT SALTS.

Substances estimated.	From l'Aisne (1).	From the Somme (2).	From the environs of Lille (Nord)	From the environs of Lille.	From l'Aisne (3).	From the Nord.
	I.	II.	III.	IV.	V.	VI.
Moisture	4·00	2·59	3·48	7·72	2·47	1·19
Insoluble matter	13·50	10·61	14·02	12·08	11·60	13·11
Chloride of potassium	18·86	15·10	20·48	33·76	10·28	29·82
Sulphate of potash ..	5·71	11·62	11·20	5·75	3·83	2·97
Carbonate of potash ..	44·28	44·70	24·72	17·00	53·50	36·50
Carbonate of soda ..	13·48	15·28	26·01	23·50	8·18	16·20
Non-estimated and loss	0·17	0·10	0·09	0·19	0·14	0·21
Total	100·00	100·00	100·00	100·00	100·00	100·00

(1). Product manufactured by the Societé des Usines de Montjean et Channy; MM. Bayard de la Vingtrie, Frères, et Cie.

(2). Ham Distillery (Somme), MM. Hurbain-Désormeaux.

(3). MM. Gunguièz et Cie., Bucy-le-Long, near Soissons.

Specimens No. 1 and 2 may be considered as types of salts of good quality. No. 5 is one of the richest with

which we have met, and Nos. 3 and 4 are the poorest. The composition of the crude potashes varies extremely, as is self-evident, each constituent element occurring in different proportions in the various examples. We have been asked by some chemists why the composition of salts has been thus formularised, and how we could prove that they did not contain, say, for instance, chloride of sodium. Setting aside the established custom in all commercial refineries of combining the elements in the mode we have adopted, our answer is that refining itself proves that this formula points out the true composition of the salts. If the refining be well conducted, all the salts indicated by this formula will be obtained, and in almost exactly the same proportions.

Potashes Derived from the Grease of Wool.—Before terminating our account of salts, a few words may be added relative to the potashes derived from grease extracted from wool-washings. The potashes made from grease analysed by us were produced by M. Thery-Disière, who is at the head of an important manufactory at Verviers (Liège), and who was the first to use baths for the purpose of steeping wool, which was, formerly, always thrown into the river. Here is the composition of one of these potashes—

POTASH OF WOOL GREASE.

	I.	II.	III.
Moisture	2·83	1·20	1·05
Insoluble matter	11·98	5·28	11·19
Chloride of potassium ..	5·88	6·12	7·04
Sulphate of potash ..	2·48	3·03	3·33
Carbonate of potash ..	71·52	79·01	72·25
Carbonate of soda	4·96	5·15	5·14
Non-estimated and loss	0·35	0·21	5·14
	100·00	100·00	100·00

Potashes extracted from wool-grease are produced in several manufactories in France, and constitute an excellent product, rich in carbonate of potash; but an important progress in this branch of manufacture yet remains to be realised, viz., the diminution, or even complete removal, of insoluble matter without recourse to refining.

REFINED POTASHES.

Refining the Salts.—The salts are broken into fragments the size of an egg, and lixiviated in water. The lixivium should mark from 20° to 25° on the Beaumé areometer; it is passed into cauldrons, where, by successive evaporations, crystallisations, and solutions, the separation of the salts is effected.

In the first set of cauldrons, the lixiviate is evaporated until it marks 40° on the Beaumé areometer; at this density, most of the sulphate of potash is precipitated. The liquid is left to settle, and decanted into crystallising pans, where the greater part of the chloride of potassium crystallises when quite cold.

The mother liquor is evaporated in the second set of cauldrons until it marks 45°, during which process it precipitates carbonate of soda. After settling, the lixiviate is again passed into the crystallising pans, where, on cooling, a new deposition of chloride of potassium takes place. The lixivium is again heated in the third set of cauldrons, and rendered sufficiently concentrated to mark either 50, 51, 52, or 53 areometric degrees. Carbonate of soda is still deposited; the liquid in the crystallising pans, when cool, still precipitates chloride of potassium, and, when evaporated to dryness, yields commercial refined potash, generally containing from 78 to 82 per cent of carbonate of potash. In order to obtain potashes refined to a still higher standard, these are dissolved at 80°, and the solution evaporated to 61 or 63 areometric degrees. Carbonate of soda is deposited, and the liquid obtained, when evaporated and calcined, yields potashes containing from 88 to 94 per cent of carbonate of potash.

Sulphate of Potash.—It has been shown that the greater part of the sulphate of potash contained in the salts was deposited during the first evaporation of the lixivium. This salt, polluted in the first instance by the impurities of the lixivium, contains, besides the alkaline carbonates, chloride of potassium. By means of rakes, the salt is taken up as it precipitates, placed to drain in vessels of perforated sheet-iron, dissolved, and subjected to a fresh crystallisation. Commercial sulphate of potash is thus obtained.

Chloride of Potassium.—The chloride of potassium successively deposited during the different phases of evaporation of the lixivium is left to drain, and, when deprived of the liquid which moistens it, is saleable. After the second or third cooling, it is not, however, sufficiently pure to be introduced into trade, and must be collected and restored to the first set of cauldrons, there to be operated upon anew.

Carbonate of Soda.—The carbonate of soda produced by evaporation of the lixivium is purified, after desiccation, by means of successive solutions and crystallisations, repeated two or three times. The soda-salt thus obtained furnishes, after calcination, commercial white soda.

It is, of course, understood that these evaporations never produce salts in a state of complete purity, and that all products thus obtained are mingled more or less with other substances. Sulphate and chloride of potassium and carbonate of soda are manufactured by other processes than those we have described. On this subject a few words will be said when discussing more especially these different salts. We will at present confine ourselves to an examination of the composition of refined potash (carbonate of potash).

METHOD OF ANALYSIS AND COMPOSITION OF REFINED POTASH.

The analysis of refined potash is effected in a precisely similar manner to that of crude potash, except that it is more rapid, on account of the non-necessity of separating the insoluble substances, which occur in only the smallest proportions.

Twenty-five grms. of refined and pulverised potash are dissolved by decantation in a flask, and the obtained lixivium is diluted to the volume of 500 c.c. Decant 100 c.c. to obtain the standard, 100 c.c. to estimate the sulphate, 50 c.c. to determine the proportion of chlorine, and 10 c.c. to estimate the potassium, by means of bichloride of platinum. The moisture is estimated by heating the potash-salt to a red heat in a platinum crucible. The analytical results given below may be considered as representative types of the different qualities of

Substances estimated.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
Moisture and insoluble ..	3·05	0·80	0·61	0·68	2·00	0·38	5·66	0·21	0·42	15·56
Chloride of potassium ..	3·21	3·35	2·61	3·22	3·41	3·41	4·68	5·81	4·00	1·47
Sulphate of potash	2·31	1·48	0·80	2·00	4·62	1·41	2·00	3·45	2·10	0·11
Carbonate of potash ..	78·10	81·22	91·25	91·88	87·51	92·87	69·25	82·68	89·37	79·86
Carbonate of soda	13·33	13·15	4·73	2·22	2·46	1·93	18·41	7·85	4·11	3·00
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
	Corbehem Distillery, near Douai; M. A. Lefebvre.			MM. Tillog-Delaune and Co., Courrierès (Pas de Calais).			X	MM. Vorster et Gruneberg, Cologne (Prussia).		Hydrated potash; maker unknown.

commercial refined potashes. As in the case of the beet-root salts, we give the names of the manufactories whence the specimens were obtained; and we here desire to thank those manufacturers who, while supplying all necessary information, have kindly authorised us to publish the composition of their products.

These results will show that commercial refined potashes contain from 69 to 93 per cent of carbonate of potash. It should be added that analyses Nos. 8 and 9 were performed upon carbonate of potassium from Stassfurt, according to the method of M. Leblanc.

(To be continued.)

PRELIMINARY NOTE ON

THE PRODUCTS OF THE DESTRUCTIVE DISTILLATION OF RESIN.

By THOMAS ANDERSON, M.D., F.R.S.E., F.C.S.,
Professor of Chemistry in the University of Glasgow.

I HAVE been engaged for several years in the investigation of the distillation products of resin. The subject having proved one of great extent and complexity, it was not my intention to have made any part of it public until it was more complete than it is at the present moment, but the recent appearance of a similar investigation by Mr. Tichborne* has induced me to alter this intention and to publish my results, especially as some of them differ from those which he has obtained.

When common colophony is distilled, the first product is a small quantity of a volatile oil, commonly known as "rosin spirit," consisting of some products of decomposition of the resin contaminated with a portion of the essential oil originally existing in the turpentine. When this is separated, an oil is obtained which becomes more and more viscid as the distillation proceeds, and shows a gradually increasing blue fluorescence as the temperature rises, and at last a small quantity of charcoal is left in the still. When this crude resin oil is rectified, the first product is a "rosin spirit," larger in quantity and somewhat different in smell from that obtained in the first distillation. This is followed by a mixture of thick oils of high boiling point, and the last product, if kept separate, acquires, on cooling, the consistency of soft butter, or rather of a mixture of oil and butter. When this is exposed to a freezing mixture and expressed, a solid crystalline substance is left on the cloth, which, when purified, proves to be the metanaphthaline or retisterene of Pelletier and Walter.

My investigations hitherto have been mainly confined to the spirit obtained in rectifying the crude resin oil. When this is submitted to a systematic fractionated distillation, it splits up into a variety of oils, and after seven or eight rectifications, fractions are obtained at all temperatures, from 70° C. up to 400°, the latter being of course portions of the less volatile oils which passed over at the first rectification.

The fractions boiling between 125° and 150° deposit a crystalline substance, which is obviously an oxidation product, and increases in quantity when the oil is preserved in partially filled bottles. This substance is Mr. Tichborne's colophonine. It is soluble in water, ether, and alcohol, and is deposited from the hot solutions in long needle-shaped crystals, which fuse at 106° and sublime easily at a higher temperature. Their smell is aromatic, and they have a warm and somewhat pungent taste. They were purified by expression, exposure to the air until the oil attached to them had evaporated, and then subliming repeatedly. The results of combustion were as follows:—

(I.) 0·425 gramme gave 1·004 CO_2 and 0·424 H_2O.
(II.) 0·2225 gramme gave 0·526 CO_2 and 0·225 H_2O.

* CHEMICAL NEWS, vol. xx., p. 38.

	I.	II.	Calculation.		
Carbon	64·43	64·47	64·61	C_7	84
Hydrogen	11·09	11·24	10·77	H_{14}	14
Oxygen			24·62	O_2	32
			100·00		130

This corresponds completely with the empirical formula $C_7H_{14}O_2$ which bears a simple relation to terebic acid, $C_7H_{10}O_4$. I have endeavoured, but as yet without success, to convert this substance into terebic acid by means of oxidising agents. By strong nitric acid it is converted into oxalic acid, with more dilute acid a resin is produced, but I have not obtained it in sufficient quantity to admit of any process of purification being applied to it. Not having analysed the crystals of this substance deposited from water, I failed to detect Mr. Tichborne's hydrate of colophonine, but the composition he gives for it is not altogether inconsistent with my formula, for a hydrate $C_7H_{14}O_2+H_2O$ would give—

Carbon	56·75
Hydrogen	10·81

The oils contained in resin spirit are very complex, and consist of a mixture of hydrocarbons, the investigation of which is still quite incomplete. The most volatile fraction, which was very small and boiled between 70° and 80°, contained a volatile acid, apparently acetic acid, which gave abundant white fumes with ammonia. After separation of this acid by washing with water and drying, the oil gave—

Carbon	84·62
Hydrogen	13·71

Though the oil obviously contains oxygen, these numbers approximate to the composition of an olefiant, and its vapour density was 3·257, agreeing sufficiently with 3·386, which is the theoretical number for heptylene. The oil is probably a mixture of this substance with some oxygenated product, but the quantity at my disposal did not permit of any process of separation being employed.

At the temperature of 107° a larger quantity of oil was obtained, also containing oxygen. It gave, on combustion—

	I.	II.
Carbon	85·90	86·44
Hydrogen	12·75	12·97
	98·65	99·41

in which the carbon agrees with that of an olefiant, although the hydrogen is deficient. As far as analysis is concerned, the oil appears to be homogeneous, for, on rectifying it and separating the first few drops and the last few drops of the distillate, they were found, on combustion, to give identical results. The action of reagents, however, leads to an opposite conclusion. When digested for some time at 220° with strong hydriodic acid, it is converted into a black oil heavier than water. This, after being washed with potash and dried, yielded on distillation two oils, one boiling at about 177°, which contains iodine, is partially decomposed by distillation, and for which no formula could be obtained, and a non-iodised oil, very viscous, with a green fluorescence, and boiling a 290°. On combustion, it gave the following results:—

	Experiment.	Calculation.		
Carbon	87·94	88·24	C_{10}	120
Hydrogen	12·19	17·76	H_{16}	16
	100·03	100·00		136

It is therefore a terpene apparently corresponding with the colophene or metaterpene of Berthelot.

Of the less volatile oils, I have as yet examined only one boiling at 157°, and another boiling at a higher temperature. The former is an oxygenated oil, with a specific gravity of 0·853. The results of its analyses in

the first instance approximated to those of terpinol, with which, however, it is only isomeric and not identical. But some results afterwards obtained lead me to suspect that it may be a product of hydration of a terpene existing in the crude oil. When treated with sulphuric acid, heat is evolved, and the oil, after being separated from the acid and purified by distillation, has exactly the smell and composition of terebene. The products at higher boiling points appear to be terpenes, but they give no solid hydrochlorates, and their separation presents difficulties which I have not hitherto been able to overcome.

I trust I may be able at some future period to throw further light on the constitution of these substances; my investigation of which must be considered for the present as entirely preliminary.

ON THE

ESTIMATION OF THE SO-CALLED PRECIPITATED PHOSPHATES IN MANURES,

AND THE

ESTIMATION OF SOLUBLE PHOSPHATES GENERALLY.

By FRANCIS SUTTON, F.C.S., Norwich.

The difficulty presented by this subject has lately been discussed in this journal from two points of view, namely, that of the manure manufacturer and the professional analyst.

Anyone who knows anything of the matter must certainly feel, with the manufacturer, that it is a real grievance to have expended time and money in producing soluble phosphate which, owing to this reducing action, is valued at only about one-third the price it ought to sell for.

Again, on the other hand, the analyst is asked to say how much phosphate of lime soluble in water is present in a particular sample of manure, and his duty is plainly to treat such a sample with water only, and state the percentage of phosphate therein.

The manufacturer says, I believe the recently-reduced phosphate is quite as effectual in action as the soluble phosphate, because I am told by good authorities that, so soon as soluble phosphates come in contact with the soil, they are rendered insoluble, and, therefore, why should not my recently-precipitated phosphates be just as valuable as the soluble phosphates? The only reply that can be made to this is that the analyst, unless he can find a reliable process for estimating recently-reduced phosphates, must consider and value them solely as insoluble phosphates. It has been proposed to use citric acid, oxalic acid, or oxalate of ammonia for the purpose of rendering these phosphates soluble, in order that they may be estimated and valued at a higher price than ordinary insoluble phosphates.

If it can be shown that any of these reagents will affect such a material as Cambridge coprolite, and render it soluble in water, it is manifest that such aids cannot be depended upon for the purpose required.

This seems to have been pretty well settled by the experiments of Mr. Hughes; but the results obtained by him have been cavilled at by one of your correspondents ("Fair Play") as being conducted in an improper way. As I am situated in the heart of a large manure-consuming district, and continually estimating phosphates, it has occurred to me to extend these experiments somewhat further, and I think the result will show that no real dependance can possibly be placed upon any of the hitherto-suggested plans for determining these reduced phosphates.

The experiments were made upon two substances, namely, a mineral superphosphate which originally contained about 23 per cent of soluble phosphate (calculated as bone-earth), but which, at the time of the first experiment, yielded only between 17 and 18 per cent, together with about 10 per cent of insoluble; the other substance was raw Cambridge coprolite, containing about 56 per cent of insoluble phosphate of lime. All the determinations were made by the acetate of uranium process, in the presence of a slight excess of free acetic acid.

1. One grm. superphosphate, treated first with cold and afterwards with hot water, yielded 17·7 per cent soluble phosphate.

2. One grm. finely-ground coprolite, treated precisely in same manner (as might be expected), gave no soluble phosphate.

3. Residue of No. 1, boiled with 100 c.c. water and 4 c.c. strong acetic acid, yielded 2·3 per cent soluble phosphate.

4. One grm. coprolite, with same proportions of water and acetic acid, gave 4·8 per cent soluble.

5. One grm. of the superphosphate, heated with equal parts of acetic acid and water, gave 19·5 per cent soluble.

6. One grm. coprolite, treated in same manner, gave 9·9 per cent soluble.

7. One grm. coprolite, heated with 1 grm. citric acid and 100 c.c. water, gave 10·4 per cent soluble.

8. One grm. coprolite, with same quantities of tartaric acid and water, gave 10·8 per cent soluble.

9. One grm. of same superphosphate, digested in the cold with ½ litre of water for twelve hours, gave 14·8 per cent soluble.

10. One grm. of the same superphosphate, but some five or six weeks older, was put into a vessel with ½ a litre of water, and charged with 10 volumes of carbonic acid for five hours; the yield was 13·8 per cent soluble.

11. One grm. coprolite was treated precisely in same manner, and gave slight traces only of soluble phosphate.

12. 2·5 grms. same superphosphate, digested in the cold with 2·5 grms. oxalate of ammonia in ½ litre of water for twelve hours, gave 16·0 per cent soluble.

13. 2·5 grms. coprolite, digested in the cold with same weight of oxalate in ½ litre of water for twelve hours, gave no soluble phosphate.

14. 2·5 grms. superphosphate and 2·5 grms. oxalate of ammonia were mixed with ½ litre water, and heated on the water bath one hour; the yield was 17·1 per cent.

15. One grm. superphosphate, with 1 grm. oxalate, were mixed with 50 c.c. water, and digested half an hour on water-bath; the yield was 19·4 per cent soluble.

16. Same weights of both were mixed with 50 c.c. water, and digested in the cold twelve hours; the yield was 17·6 per cent soluble.

17. One grm. superphosphate, with 1 grm. oxalate, were mixed with 50 c.c. water, and boiled ten minutes; the yield was 22·6 per cent soluble.

18. One grm. coprolite, boiled for same time in 50 c.c. water and 1 grm. oxalate, gave 10·8 per cent soluble.

The results of these experiments are, in some respects, anomalous, but a little consideration will probably throw some light on the matter.

The superphosphate here examined contained considerable quantities both of iron and alumina; and it seems that it is only such phosphates that are, to any considerable extent, liable to this reduction. The true explanation of their action in this respect I cannot pretend to give, nor have I heard of any being given by others; it is, however, well known that raw phosphates containing these substances make very soft and pasty manures, which, before they can be rendered marketable, must be dried by the addition of some absorbing substance which, as it removes the constitutional water from the iron or alumina phosphates, converts them into some basic form which is not soluble in plain water. If it be the case that iron or alumina, or both, are at the bottom of this matter, this explains the slight effect which acetic acid has upon the residue of this particular superphosphate after exhaustion with water (see experiments 3 and 5); while the plain coprolite, containing only slight traces of iron or alumina, yields double the percentage of soluble phosphate under the same treatment in experiment 4, and about five times as much in experiment 6.

With regard to the effect which oxalate of ammonia has upon reduced phosphates, it appears that no very great increase of soluble phosphate is obtained by dilute solutions in the cold, nor upon coprolite; but when a boiling heat is used, and the solution concentrated, a considerable yield is obtained in the case of the reduced phosphates, and as much as 10·8 per cent from the coprolite.

It does, therefore, appear that, where a superphosphate contains the so-called reduced phosphates, their amount may pretty nearly be found by the use of oxalate of ammonia in a boiling solution. But it is quite another question whether the phosphates so recovered are as valuable as if they were soluble in water; at any rate, carbonic acid, under considerable pressure, has no more effect upon them than it has upon raw coprolite. The thing which does affect them, namely, oxalic acid, acts upon hard raw coprolite still more; and this does not favour the supposition that they are as valuable as if they had never been reduced.

Again, suppose a manufacturer chooses to mix off some tolerably pure form of insoluble phosphate with a superphosphate liable to reduction; the analyst who used the oxalate process for estimation would, probably, report several per cents of soluble phosphate in the manure which had never been in the soluble state at all, and the farmer would be asked to pay about three times as much for such phosphates as he might have bought them for in the form of coprolite.

Under such circumstances as these, it, therefore, seems that the duty of the analyst is plainly to state the absolute truth—namely, that such a sample of manure contains so much phosphate of lime soluble in water—and there leave it. I repeat that this is a hardship to the maker, in many cases; but I am not certain that it is necessary for him to incur this risk.

I would now say a word or two relative to the method of estimating soluble phosphates; the stigma which has been brought upon professional chemists in general by the fact that some well-known professional men invariably give high results, while others, also, invariably give low ones, is considerable, and ought, if possible, to be removed.

This discrepancy may, in most cases, be accounted for by the process adopted in determining the phosphates; and, in order to remedy this evil, I would recommend the universal use of one process only, granting that a good and reliable process can be found.

All chemists are aware of the good effect which has resulted from the adoption of this system in silver assaying by the wet method and others of like nature; and I see no reason why it should not be adopted in the matter of soluble phosphates. There may, of course, be a difference of opinion as to what process shall be adopted, but I know of none so reliable for manures of all descriptions (for soluble phosphates), as the uranium process by weight (fully described by me in this journal of February 4th and 18th, 1860). A very large number of analyses made in my laboratary since that time, and tested by every conceivable comparison, have brought the conviction that no other process is, at the same time, so short and so exact, and is quite available, without modification, in the presence of iron or alumina phosphates usually found in some samples of manure. An analysis can be begun and completed within three hours; and, of course, a series may be carried on at one and the same time, if a sufficient number of vessels are at hand. The objection against the process, on the ground of expense, amounts to nothing, since the whole of the uranium can be recovered again for repeated use.

To Melt Two Metallic Mixtures by Friction.—Melt, in one vessel, one part of mercury and two parts of bismuth; and in another one part of mercury and four of lead. When cold, they will be quite solid, but, by rubbing them against each other, they will soon melt, as if each had been rubbed separately against red-hot iron.—*American Artisan.*

DETECTION OF POTASH AND SODA BY BLOWPIPE VESICULATION.

THE following letter and list of experiments has been forwarded by Capt. W. A. Ross, R.A., to Professor Theodore von Richter, Head of the Royal College of Freiburg, and also to us for publication in the CHEMICAL NEWS:—

Simla, India, June 17th, 1869.

Dear Sir,—In accordance with the request contained in your letter of the 1st of January, 1868, to my address at Woolwich, to be informed of the result of my further labours in the matter of blowpipe vesiculation discovered by me, I have the pleasure now to communicate the following:—On arriving here in April, the weather being very warm and dry, and an aneroid barometer compensated for heat standing only at 22·80°, I made some borax vesicles of KOHO and CaCl, and other of the most deliquescent salts I had, none of which, to my surprise, either deliquesced or showed the least sign of crystallisation. They remained unchanged until the 8th of June, when very heavy rain fell the whole day and night. Next morning the potash vesicle had partly deliquesced, and the rest were covered with crystals. From this fact I ascertained that the vesicular crystallisations of borax discovered by me are all superposed, or formed from the hygrometric moisture of the air, and not pyrogenous, or formed from the hot borax on cooling, like those mentioned by Berzelius (pp. 64, 190, 214, &c., of the American Translation, Boston, 1845), Rose of Berlin, and other writers. As it appeared to me that the moist atmosphere could only act with uniformity on uniformly composed substances presented to it for crystallisation, I strove to attain something like uniformity by measuring 50 milligrammes of borax for each bead, taking up as near as possible an equal quantity in each case of the substance to be examined. I found this a troublesome process, and hit upon a far easier and equally exact method—by measuring the bead after it had cooled, by slipping over it a glass tube of the diameter of 5° on the lead measure, filing a shoulder on the top of the platinum wire holder to allow the tube to stand upright over the wire, and then seeing with the magnifying glass how far the sides of the bead (placed with the wire next the eye) were from touching the sides of the tube. I reflected, however, that borax, being a compound salt, could scarcely be expected to give uniform results chemically, either as regards crystallisation or any other operation, and connecting the fact in my mind that alkalies and alkaline earths always give a cloudiness to vesicles of borax in moist weather with the other facts—(1) that the "boron diamond" can only be attacked by the fused hydrates of the alkalies; and (2) that alkaline borates are freely soluble, while those of the other bases are either insoluble or very sparingly so—I determined to operate if possible on pure boracic acid. I was much pleased to find that substance easily blown into vesicles (having expected the contrary), as it is very viscid when the HO and air bubbles are expelled from it, and I found that its vesicles, being thinner than those of borax, invariably possessed a most brilliant iridescence. But the most useful feature to me was the fact of their clouding over a few seconds after formation, with a delicate blue white film upon which the iridescent colours, gleaming beneath, bestowed a beautiful opaline or mother-of-pearl lustre which I have called "opalescence." I immediately saw that as the borax vesicle is clear and the boracic acid one opaline, a valuable and sure means of detecting the presence of soda, at least in the proportion in which it enters into the composition of borax, is thus afforded, for that amount of soda in the subject of analysis would of course combine with the BO_3 forming a boracic acid (or clear) vesicle. I will not fatigue you with details of the experiments I made, 48 of which I have the pleasure to enclose. You will be able to draw just conclusions from them or others repeated far better than

I can possibly do, but I may venture to state that my object hitherto has been almost exclusively confined to a means of isolating, by this method, potash from soda, the blowpipe flame and oxide of nickel tests being, as you are aware, almost worthless, and that, by the wet analyses, a long, tedious, and difficult operation. Without troubling you with details (which will be found in the experiments), I ventured to conclude—

1st. That soda and fluor spar (CaF) interfere with the opalescence of BO_3 vesicles.

2nd. That potash does not interfere with it.

3rd. That chlorine increases it both as to quickness of appearance and intensity.

4th. That CO_2 causes it to appear after a time weakly, even in the presence of soda.

I regret I have no pure or caustic soda to operate with, nor can I obtain it nearer than Calcutta. Experiments 17 and 20 show that 10 to 13 c.c. of potash Alaunstein can be detected by this method in presence of 53Fl and 32 soda (in kryolite), and, on the other hand, experiment 48 shows that, without soda as a constituent, potash alone fails to neutralise the effect of CaF in preventing the opalescence of vesicles of boracic acid.

I have, as you will see, attempted scarcely anything but the two alkalies—the acids and metals, &c., remaining for future examination. It was easy enough to distinguish by this method between potash and soda in pure salts, but I found it more difficult when applied to traces of those alkalies in silicates; still, I discovered, as you will see, traces of potash by this means in the soda minerals, "albite, analcine, and labradorite," supplied me from Freiberg, while kryolite showed not a trace, and when artificially supplied with KO from Alaunstein, immediately showed a strong trace of that alkali.

Besides being (I hope) found to be most useful in detecting soda and potash in minerals, and of making BO_3 and CaF betray each other, these boracic acid vesicles form the most delicate hygrometers possible, clouding over with a rapidity proportional to the amount of moisture contained in the atmosphere. If the air is so very dry that even boracic acid vesicles take some time to opalesce, the addition of chlorine will make them still more sensitive, and if the air is very moist, that of CaF far less so, until absolute insensibility (or transparency) is attained. I regret that the departure to-day of the mail prevents my saying more at present on this interesting subject. Pray let me know what results your experiments on the subject give, and believe me, yours with great respect,

W. A. Ross.

EXPERIMENTS IN VESICULATION WITH BORACIC ACID, JUNE 13, 1869.

(Bar. 22·70; Ther. 82; Air, very dry).

1. BO_3 + KOHO.	Opalesced in four minutes.
2. BO_3 + $NaOCO_2$.	Remained quite clear for hours.
3. BO_3 + $KOCO_2$.	Opalesced in fifteen minutes.
4*a*. BO_3 + NaCl.—At first I took a large quantity of BO_3, and could not take enough Na from the NaCl to satisfy it, as the bead dropped off.	The BO_3 therefore apparently seized upon a part of the Cl (which came off in thick fumes) and the vesicle clouded over the moment it was taken from the flame.
4*b*. Tried NaCl again, in large quantity, with very little BO_3.	Fumes of Cl, when stopped vesicle made; remained quite clear ever since up to to-day (June 17).
5. BO_3 + MoS.—The native sulphide.	Clouded (not opalesced) in quarter of an hour; afterwards crystals formed exactly like leopards' spots.
6. Tried 4*a* and 1 near the flame of spirit lamp.	Opalescence vanished immediately, leaving a clear dry vesicle exactly like the volatilisation of the sublimate of arsenic from charcoal before the blowpipe.
7. Alaunstein.	Opalesced in fifteen minutes.
8. Kryolite.	Remained quite clear to date; vesicle much less fragile and iridescent than those of BO_3, and bead more fluid.
9. Adular.	Opalesced slightly in twenty minutes.
10. Albite.	Faint opalescence after quarter of an hour.
11. SiO_2 powdered.	The SiO_2 remained undissolved; the BO_3 opalesced strongly after quarter of an hour.
12. Vesiculated KOHO in borax; made a hole with pin at top, and breathed upon it.	Deliquesced rapidly and translucently on the edges of the hole, without having clouded over or opalesced in any way; crystals afterwards formed on edges of the hole.
13. Breathed upon 1 and 4*a* when freshly re-made.	Both rapidly opalesced, but when heated very gently near spirit lamp, frothed instead of vanishing.
14. Mixed 11 with a little kryolite.	Opalesced slightly.
15. Mixed ditto with NaCl, driving off the Cl well, as I did not think it had Na enough.	Remained quite clear to date (17th).
16. Analcim.	Very difficult to make; opalesced faintly in quarter of an hour.
17. Ditto, with CaF.	Remained quite clear to date.
18. Labradorite.	Opalesced pretty strongly in twenty minutes.
19. Ditto with CaF.	Remained quite clear to date.
20. Mixed 7 and 8.	Opalesced pretty strongly.
21. „ 7 with CaF.	Remained quite clear all night.
22. „ 9 „ „	„ „ „
23. „ 10 „ „	„ „ „
24. Re-made 12 and added BO_3.	Remained clear for twenty-five minutes.
25. Re-made 1 and added $NaOCO_2$.	Opalesced faintly in quarter of an hour.
26. Re-made 21, 22, and 23, and added KOHO to each in large quantity.	Remained quite clear to date.
27. Pure boracic acid.	Opalesced round platinum wire in thirty seconds.
28. Re-made 4*a* and 1 fresh.	Opalesced in a few seconds 4*a* quickest.
29. Re-made 20 and added $NaOCO_2$.	Remained quite clear to date.

30. Added BO_3 to 24.	Remained clear for twenty minutes.
31. Added $NaOCO_2$ to 25.	Opalesced very faintly in quarter of an hour at one end only.
32. Added more $NaOCO_2$ to ditto.	Remained quite clear to date.
33. Added much BO_3 to 30.	Bead very fluid; opalesced in quarter of an hour.
34. Re-made 27.	Opalesced slightly in one minute; all over in twenty minutes.
35. Added NaCl to much BO_3.	Began to opalesce in thirty seconds; completely opalesced in two and a half minutes.
36. Added more NaCl to ditto.	Remained quite clear.
37. BO_3 + CaCl to saturation.	No Cl disengaged; vesicle clouded mechanically with Ca.
38. BO_3 + very little CaCl.	Opalesced in one minute, but did not increase.
39. Pure boracic acid.	Opalesced slightly in half a minute; all over in five minutes.
40. Re-wetted 37 with geblase.	Bead opaque; vesicle opalesced in ten minutes.
41. BO_3 with slight trace CaF.	Opalesced in quarter of an hour.
42. The same with double CaF.	Remained quite clear to date.
43. BO_3 with trace CaF.	Opalesced in quarter of an hour.
44. Pure boracic acid.	Opalesced slightly in half a minute; all over in three minutes.
45. $NaOCO_2$ (sub-carbonate).	Opalesced slightly in ten minutes.
46. „ (double quantity).	Opalesced considerably in quarter of an hour.
47. „ (more $NaCO_3$).	Remained clear to date.
48. Added KOHO to 42.	„ „ „

MISCELLANEOUS.

British Pharmaceutical Conference.—The meeting for the present year will be held during the third week in August, at Exeter, in the College Hall, under the Presidency of Mr. Daniel Hanbury, F.R.S. On Tuesday, the 17th, at 10 a.m., the President will deliver an address; the reading and discussion of papers on pharmaceutical subjects will then commence, be continued in the afternoon till 4.30, and be carried on during Wednesday; an adjournment from 12.30 till 2.0 taking place each day. On Thursday a complimentary entertainment to their visitors will be given by the chemists of Exeter. On Friday, the chemists of Torquay invite members to view some points of interest in the neighbourhood and partake of luncheon.

University of London.—The following are lists of the candidates who have passed the recent examinations in Arts and Science. *First B.Sc. Examination* (*Pass Examination*).—First Division. Edward Bibbins Aveling, University College; Walter W. Rouse Ball (First B.A.), University College; Henry Septimus Bott, Owens College; Frank Clowes, Royal College of Chemistry and Pr. st.; John William Elwes, King's College; Thomas Oliver Harding, B.A. University College; Marcus Manuel Hartog, University College; Charles William Hodson, Chester College; David Bridge Lees, B.A. Camb., Owens and Trinity College, Cambridge; Robert Routledge, Owens College. Second Division. Hampden Gurney Jameson, University College; Sidney Follett Osler, University College; Charles Rigg, Chester College; Robert Davies Roberts, University College.

The Metric System of Weights and Measures.—The second report of the Standards Commission has just been published, together with an appendix of detailed information. The Commissioners confine themselves in this report to the questions connected with the metric system, and with its adoption in the United Kingdom; and they consider the reasons for and against its introduction under two heads—namely, those which relate to the internal commercial transactions of the country; and those which relate to transactions with other countries. With regard to the former, they observe that there is at present no inconvenience arising from the discordance between the customary weights and measures, because, whatever difference may prevail as to the multiples in local use, the essential units—the yard, the pound, and the gallon—are everywhere the same; based upon standards which are constructed with the utmost skill and care, and supported by a system of inspection which, though chargeable with imperfections, is, on the whole, efficient. Moreover, the requirements of different trades need somewhat different bases. The yard is a very convenient length for draper's measures, but the foot is far more convenient for carpenter's measure. It has been remarked that the last, or coomb, the bushel, and the peck, are well suited for men's backs, arms, and hands; and also that the natural inclination of the mind to halve and quarter continually exhibits itself in the subdivision of almost every base. The metric system does not offer facilities either for the change of the adopted base, or for the continued binary subdivision; and any attempt to force it into use in shops and into workmen's operations and accounts would propably be felt as a needless grievance. At the same time the want of weights and measures on a decimal scale generally, or on the metric scale specifically, is not unfrequently felt by the manufacturing and trading classes, and more especially by men of science and by chemists and engineers of the highest class; and it appears hardly possible to satisfy this want except by the legal establishment of metric standards, and by the legal sanction of the use of metric weights and measures in shops and offices of conveyance. In order to prevent confusion, it would be necessary to provide that the metric weights and measures should have such form or other characteristics as would render it impossible to mistake them for those of the existing system; and in a future report the Commissioners promise to deal with the question of further simplification by the abolition of troy weight. Passing on to our transactions with foreign countries, the Commissioners remark upon the recent great increase in the amount of these transactions, and argue from it to the permissive adoption of the system which agrees with that of so many of our foreign trade correspondents, as well as to the giving the ordinary statistical publications relating to trade on the metric as well as on the imperial system. Attention is next called to the degree in which the introduction of a decimal system of coinage would assist in rendering the public familiar with the use of decimal weights and measures; and the report concludes by recommendations arranged under nine heads. These recommendations are, in substance, that metric standards under the French nomenclature should be legalised and provided, but that the use of the system should be entirely permissive, and not even in prospect compulsory; that regulations should be adopted to prevent confusion between the two classes of weights and measures; that Customs and other duties might be levied and the business of public departments conducted by either system; that mural standards of both systems should be exhibited in public places; and that the decimalisation of our system of coinage should be undertaken by the Government. At the same time it appears to the Commissioners to be essential that any measure for the introduction of the metric system should be proposed to Parliament by the Executive Government; and, considering that the Commission will shortly enter upon the questions referred to, those relating to the system of local inspection of weights and measures throughout the United Kingdom, its members are of

opinion that "it is expedient that no legislation should take place with respect to the metric system until the whole subject of the weights and measures of this kingdom be brought before Parliament in one Bill."

The British Association.—Great preparations are being made at Exeter for the reception of the British Association next week. A new hall has just been completed capable of holding 2000 persons. The new wing of the Albert Museum is also finished. Various excursions are organised; and altogether the association week is expected to be very successful. The President-elect, Professor Stokes, is to be the guest of Lord Devon, at Powderham, where there will be several other distinguished guests. Lady Rolle will likewise receive a number at Bicton. Lord Clifford will receive the Abbé Moigno. Sir Stafford Northcote will entertain, at Pynes, Lord Fortescue, Lord Stanley, M.P., Lord Houghton, Lord and Lady Colchester, Sir C. Trevelyan, Mr. Baring, and others. Sir Henry Ferguson Davie will have staying with him, at Creedy, Col. Sykes, M.P., Mr. D. Dalrymple, M.P., Professor Newton, Professor Lawson, &c. At Claremont, Sir John Bowring will entertain Professor Huxley and several distinguished foreigners. The order of proceedings starts with a general meeting of the council and committees of sections of the association on Wednesday, the 18th inst., when the committees and officers of the various sections will be appointed. On the same evening, the President, Professor Stokes, will deliver the inaugural address at the new Victoria Hall. On the following day, the presidents of the seven sections will deliver their addresses, and the reading of the papers will commence. A *soirée* will be held on Thursday evening in the Museum. On Friday evening, Professor Phillips, D.C.L., F.R.S., will lecture on Vesuvius. Saturday will be slack in the sections, as there are to be two excursions on that day—one to the extreme west, and the other to the extreme east of the county; but in the evening Professor Miller will deliver his lecture to the operative classes in the Victoria Hall. As it is intended for working men and their families, the price for admission is fixed at 2d., and it is fully expected that there will be very numerous applications for tickets. On Monday, the sectional meetings will be supplemented by a lecture on the sun, to be delivered in the Victoria Hall by Mr. Norman Lockyer. The sections will resume work on the Tuesday; and on Wednesday, the 26th, the British Association week in Exeter will terminate with the Mayor's luncheon at the Royal Public Rooms.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, vol. lxix., No. 4, July 26, 1869.

A very considerable portion of this number is again devoted to an apparently never-ending dispute about the Pascal, Newton, and Chasles-Le Verrier controversy. Among the papers we notice:—

Researches on the Products of Oxidation of the Principal Normal Alcohols.—MM. Pierre and Puchot.—The authors have used the well-known plan of acting with bichromate of potassa and sulphuric acid upon the alcohols submitted to experiment. They distinguish, among the products of this reaction, between the normal acid belonging specially to an individual alcohol, its aldehyde, and the compound ether, which are proper to each separate alcohol; for instance, with amylic alcohol, valerianate of amyl may be obtained; with butylic alcohol, butyrate of butyl may be produced. The authors describe, at great length, what precautions are in general required to be observed in experiments of this kind, and then specify the following particulars:—(1) The preparation of valerianate of amyl, $C_{10}H_9O_3,C_{10}H_{10}O$, by the oxidation of amylic alcohol; (2) the preparation of butyrate of butyl, $C_4H_7O_3,C_8H_9O$; (3) the preparation of propionate of propyl, $C_6H_5O_3,C_6H_7O$. These preparations are concisely described.

Proposed Plan of Protecting Iron Vessels against Rust and Corrosion.—MM. Dance and Bertin.—The plan proposed by these gentlemen for this purpose, is to convert the hull of the iron vessel into a galvanic battery by placing, inside the hull, pipes and tanks made of zinc and filled with sea-water, and connected, by means of bolts and rivets in metallic contact, with the outer side of the vessel. The authors of this paper also propose the use of strips of zinc on the iron plates of the vessel immersed in the water.

Correlation of the Unequal Visibility of Colours at Twilight, and their Unequal Photographic Activity in Full Daylight.—M. Keller.—The author observes that, after sunset, those colours which are the brightest when seen by daylight, become very dark—for instance, red, orange, and yellow; while blue, violet, and indigo, which are less bright when seen by daylight, become whitish (*blanchâtres*) in twilight. The author further observes that, in a photographic print, the first-named colours produce black, and the last-named grey. White light, producing all vibrations, is capable of exciting all colours; but, since, according to the researches of the Rev. Father Secchi, S.J., the light of the sky after sunset is especially rich in blue rays, it need not excite astonishment that the less refrangible rays should be, as it were, extinguished.

Action of Permanganate of Potassa upon Cinchonine.—MM Caventon and Willm.—The principal products of the reaction of a very cold solution of permanganate of potassa added, *guttatim*, to a cold solution of cinchonine, slightly acidified with sulphuric acid, are:—(1) An indifferent, neutral compound, which unites with bases as well as with acids, which has been named by the authors, *cinchotémine*; (2) an acid capable of being obtained in crystals, which is named *carboxycinchonic acid*: (3) a substance which reduces the tartrate of copper and potassa. In addition to these compounds, the authors state that they have discovered, by this reaction, a new alkaloid, which is made up according to the formula $C_{20}H_{24}N_2O$, and which is named *hydrocinchonine*. This base fuses at 268°, cinchonine fusing at 257°; the former base is insoluble in water, difficultly soluble in strong alcohol at ordinary temperature, and more readily so in boiling alcohol. Cinchonétine, $C_{18}H_{20}N_2O_2$, is a solid substance, soluble in boiling water. Carboxycinchonic acid, $C_{21}H_{14}N_2O_4$, is a solid substance, pretty readily soluble in water, and obtainable in crystallinel state; it is a bibasic acid which forms with alkalies and baryta very soluble salts.

August 6, 1869.

Leaving, again, the purely mathematical and physico-mathematical papers, and also the voluminous papers on the controversy about the Newton, Galileo, Le Verrier, and Chasles papers and communications, we notice the following papers:—

Laws Governing the Solution of a Substance in Two Solvents.—MM. Berthelot and Jungfleisch.—This paper is not well suited for abstraction; but the subject it treats of may be stated in a few words, while we reserve the paper for more full treatment in our pages at a future time. All chemists know that it often happens that, in order to obtain from its solution, in water, for instance, they make use of ether, or other fluids not miscible with water, to extract therefrom any substance, *e.g.*, bromine or iodine, dissolved therein; the ether thus applied acts purely by its physical properties. The authors in this paper give, at length, the results of their researches on this subject which is very ingeniously treated.

Researches on Alloys.—M. Riche.—This paper is a continuation of a series of communications on this subject by the same author. While the hardening of steel has the effect of decreasing its density as already long since stated by M. Caron, it was thought that this same effect was produced in bronze sonorous instruments, as, for instance, the Chinese gongs. The author finds that hardening and annealing are two operations the effect of which is totally different for steel and for bronze; whilst hardening has the effect of decreasing the density of the former, it increases that of the latter; annealing, on the other hand, increases the density of steel, and decreases the density of hardened bronze. Copper, repeatedly hardened and annealed, does not perceptibly vary in density.

A New Pyrometer.—M. Lamy.—The author proposes to use pure Iceland spar, basing the use of this substance, as a pyrometer, upon the law of dissociation.

Synthesis of Glucosides.—M. Schützenberger.—We reserve this paper for full translation in our columns.

Action of Anhydrous Sulphuric Acid upon Perchloride of Carbon.—M. Schützenberger.—When in perchloride of carbon, CCl_4, anhydrous sulphuric acid is dissolved, there is instantaneously observed a smell of phosgen gas, and when the solution is heated upon a water-bath, chloroxycarbonic gas is regularly given off. When this evolution of gas ceases, there remains in the retort a fuming liquid, which, on being submitted to distillation, yields, at about 75°, the excess of perchloride of carbon; next, the thermometer rises to 130°, and at that

temperature nearly the whole of the liquid distils off. The distillate is a colourless liquid, fuming in the air, and, on contact with water, instantly decomposed into hydrochloric and sulphuric acids; on being analysed, this liquid yields results leading to the formula, $S_2O_5Cl_2$, that is, an oxychloride of sulphur. The action of anhydrous sulphuric acid upon perchloride of carbon can, therefore, be represented by—

$$S_2O_6 + CCl_4 = S_2O_5Cl_2 + CCl_2O.$$

Gases Given Off by Fruit.—MM. Lechartier and Bellamy.—The authors prove, in this paper, that various kinds of fruit, after having been plucked from the trees—for instance, apples, cherries, gooseberries, and currants—begin to absorb oxygen and give off carbonic acid. The paper enters into lengthy quantitative details on this subject; as a proof that the quantity of carbonic acid given off by large quantities of fruit, say apples, for instance, stored up, may be considerable; suffice it to notice that five apples, weighing together 348 grms., yielded, from the 19th of January last up to the 15th of July last, 6648 c.c. of carbonic acid gas.

New Synthetical Method for the Preparation of Naphthalin-carboxylic Acid.—M. Eghis.—The author mixes monobromide of naphthaline, chloroxycarbonic ether, and sodium amalgam; and, after a complicated set of operations and purifications, obtains, as result, a solid substance, readily soluble in alcohol, ether, and boiling water, fusing at 160°, and yielding, on elementary organic analysis, results leading to the formula $C_{11}H_8O_2$. An identical substance was obtained by Prof. A. W. Hofmann, from cyanide of naphthaline derived from oxalate of naphthylamine; the body here in question was named by the last-named *savant*, menapthoxylic acid, or naphthalin-carboxylic acid.

Cosmos, July 31, 1869.

We quote from this paper a brief account of—

The Rio Vinagre.—This river has its source at a height of 3500 metres above sea level, near a very difficultly accessible spot of the volcano named the Puracé. The late Alexander von Humboldt first ascertained that the water of this river contains free sulphuric and hydrochloric acids. According to M. Boussingault, this river discharges into the Rio Cauca, wherein it falls from a height of 125 metres, during every twenty-four hours, 34,784 cubic metres of water, containing 37,611 kilos. of strong sulphuric acid, and 31,654 kilos. of concentrated hydrochloric acid. The Rio Cauca, after having received the waters of the first-named river, does not feed any fish for a distance of 18 kilometers of its seaward course. The volcano Puracé is not provided with a crater, as ordinarily met with on volcanoes, but its main outlet is a longitudinal split, 2 metres in length by 1 in width; it is covered at the top with a layer of very pure sulphur of about half a metre thick. There is at all times a strong escape of gases and vapours from the main outlet of this curious trachytic mountain, accompanied by a loud noise akin to that of the blowing off of the steam of several large high pressure steam-boilers. In the island of Java there are several rivulets and small lakes also containing free sulphuric and hydrochloric acids; while in one locality on the island of Sumatra, a lake is met with which contains free nitric acid. All these phenomena are caused by active volcanic action.

The American Journal of Science and Arts, No. 141, May, 1869.

We notice from this periodical the following original papers, omitting such as relate to astronomy, mathematics, and mechanical science:—

Atomic Volumes of the Elements.—M. Frank Wigglesworth Clarke, S.B.—This is a continuation of an essay on this subject from former numbers of this periodical. The author says, in his introduction to this part:—"In a recent paper in this journal I called attention to some remarkable relations which seem to exist between the atomic volumes of certain elements in the liquid condition. Since that time, I have found similar relations between the same elements in solid state, and also between the atomic volumes of some other solid elements, of which no liquid compounds are known. A few relations between the atomic volumes of different metals have been previously observed; chief of these, we find the equality of the atomic volumes of the metals of the iron group, the similar equality connecting the platinum metals, the equality between silver and gold, and that between molybdenum and tungsten. But, as far as I have been able to learn, nothing seems to have been done towards studying the more remarkable multiple relations which connect the members of certain natural groups together." The author next proceeds to the review of the alkaline metals, quoting the specific gravities as follows:—Lithium, 0·589; sodium, 0·972; potassium, 0·865; rubidium, 1·52. Upon dividing the atomic weights of the four metals, by these specific gravities, we get, as their atomic volumes, respectively, the numbers 11·9, 23·7, 45·1, and 56·2. It will be at once seen that the three highest of these values are very nearly multiples by whole numbers of the lowest. The author reviews, next, the oxygen group, oxygen, sulphur, selenium, and tellurium; after this, the nitrogen group, the carbon group, and metals. The very brief sketch given here may, perhaps, be followed by a more full and extended abstract in our journal afterwards.

On some Minerals from Newlin Township, Chester Co., Penn.—S. P. Sharples.—The first mineral described is *Diaspore*, containing, in 100 parts:—Silica, 43·56; alumina, 38·16; water, 5·64; potassa, 10·81. Specific gravity, 2·87. Colour varies from white to greenish or yellowish; it fuses before blowpipe-flame with extreme difficulty, forming a white enamel. *Lesleyite*.—Colour, white to reddish; hardness, about three; streak, white; before blowpipe flame, loses water; does not fuse with borax; does not dissolve in hydrochloric acid; is specifically heavier than quartz, its specific gravity being 3·203. It contains, in 100 parts:—Silica, 33·59; alumina, 55·41; potassa, 7·43; water, 4·30. *Paltersonite* contains in 100 parts:—Silica, 30·20; peroxide of iron, 14·88; alumina, 20·55; magnesia, 1·28; potassa, 11·35; water, 11·73.

Note upon the Origin of the Phosphatic Formation.—C. U. Shepard, sen.—The formation here alluded to is a very extensive one found in Southern Carolina. The paper is entirely of geological interest only.

On some Derivatives of Trichlormethyl-sulphon-Chlorid, $(CCl_3)SO_2Cl$.—M. O. Loew.—This paper will be given *in extenso* in our next number.

Notes on the Occurrence and Composition of the Nodular Phosphates of South Carolina.—C. U. Shepard, jun.—It appears that the specific gravity of this phosphatic mineral varies from 1·94 to 2·54; the quantity of water varies from 5·60 to 9·15; carbonic acid varies from 2·55 to 6·62; sulphuric acid, from 1·8 to 2·87; phosphoric acid, from 24·95 to 30·17, all in 100 parts. The mineral contains, besides lime, alumina, oxide of iron, magnesia; sand, varying from 4 to 15·7 per cent; and traces of chlorine, fluorine, and sodium. The author adds the analysis of the water of an artesian well, at Charlestown, S.C. This well is 1250 feet deep; the temperature of the water at the spout is 87° F. Specific gravity of the water, at 15°, is 1·0015; the amount of solid ingredients in the water = 0·228 to 0·234 per cent. In 100 parts of solid ingredients are found:—Bicarbonate of soda, 52·749; chloride of sodium, 47·051; bicarbonate of lime, 0·0883; bicarbonate of magnesia, 0·01375; silica, 0·00102; phosphates of lime, iron, and alumina, 0·0004; organic matter, 0·0017. In 100 imperial gallons of this water at 15° are contained about 1¼ lbs. of bicarbonate of soda, and 1¼ lbs. of common salt.

Certain Phenomena of Transmitted and Diffused Light.—Carey Lea.

The Cohahuila (Mexico) Meteoric Irons of 1868.—Mr. J. Lawrence Smith.—It appears that the region of Mexico bordering on Texas has been most profusely furnished with these celestial visitors; six masses, weighing, respectively, 290, 430, 438, 550, 580, and 654 lbs., have been brought to the United States. They are irregular compact masses, without any evidence of stony minerals; they belong to the softer irons, not difficult to cut with a saw. A sample taken from one only of these masses has been as yet submitted to research. Specific gravity, 7·692. It contains, in 100 parts:—Iron, 92·95; nickel, 6·62; cobalt, 0·48; phosphorus, 0·02; copper, a very minute quantity.

On Atomic Ratio.—Mr. Josiah P. Cooke, jun.—This paper treats on the so-called oxygen ratio used by mineralogists, and is more a mineralogical than strictly chemical paper.

Formation of Sugar in the Liver.—Dr. George F. Barker.—A physiologico-chemical essay.

This number of the periodical contains, as usual, a copious amount of scientific intelligence, but, since this is chiefly a reproduction from European prints, or is otherwise of local interest only, we do not notice it, the more so as there is nothing therein contained of interest which has not already been noticed by us in our journal.

Annalen der Physik und Chemie, von Poggendorff, No. 6, 1869.

This periodical contains the following original papers:—

Cohesion Exhibited by Rock-Salt in Different Crystallographical Directions.—Dr. Sohncke.—The author of this paper gives an account of his experiments on the resistance exhibited by rock-salt to tractive forces, applied thereto in a similar manner as is done to wood, metallic wires, and other solids. The paper is, however, not well suitable for proper abstraction with due justice to the author's labour, and could not, moreover, be well understood without the reproduction of a large number of tables.

Description of a Photometrical Method of Measurement and Comparison of the Intensity of Coloured Light.—M. C. Vierordt.—A large-sized engraved plate accompanies this paper.

Isolating Intermediate Layer (Zwischenschicht) of a Condenser.—M. W. von Bezold.—A mathematico-physical essay.

Point of Solidification of the Component Portions of Fluid Mixtures.—C. Schultz.—The author proves, by quoting a large number of instances, that, in a mixture of solid bodies which are miscible in a fluid state, without thereby calling forth chemical reactions, a return to the fluid state, may, and actually does, take place at a temperature below the melting-point of the most easily melting substance. This fluidisation takes place more readily, and with a less amount of absorption of heat, when the temperature, at the time of making the mixture, is so high that one of the component parts thereof is already fluid, as, for instance, is the case when salts are dissolved in water, or in alcohol, and when amalgams are mixed with mercury. The author of this paper records a large number of substances he has experimented upon.

Freezing Point of Water containing Gases in Solution, and on the Regelation of Ice.—M. Schultz.—The author states that, as a general rule, the point of solidification of fluids is lowered by substances dissolved therein, and that gases dissolved in fluids exercise the same effects. The fusing point of pure acetic acid is 16°; this is lowered to 15·2° when a current of carbonic acid is transmitted through this acid. That hydrochloric acid gas and ammonia gas do lower the freezing temperature of the water they are dissolved in is a well-known fact; carbonic acid and sulphurous acid gas do the same; and the author found that nitrogen, oxygen, and hydrogen gases exert, when dissolved in water, the same effect. The author records

a series of experiments made by him with the view of ascertaining the effect of an increase of pressure brought to bear upon the absorption of various gases by water, and the lowering of the freezing point of that liquid in consequence thereof. By the phenomenon of regelation is understood that property exhibited by ice of freezing together to a solid mass, when pieces of that substance are pressed together at the temperature of 0°. After quoting the opinions of Messrs. Faraday, Forbes, Thomson, and Helmholtz on this subject, the author says—When we take it for granted that regelation is the formation of ice from water anew, we must bear in mind that only pure water, or water, at least, not saturated with air, is suitable for this purpose. The author has studied the influence divers gases exert upon this phenomenon, but the description of his experiments is too lengthy to admit of further quotation.

Fluids Enclosed in Minerals.—M. Vogelsang.—This paper is an appendix to a paper on the same subject published in a former number of this periodical. The chief result of the author's researches is the fact that fluid carbonic acid is far more generally met with enclosed in large masses in stone, and that the conditions under, or during which that condensation took place, are as yet only very scantily known.

Influence which Mechanical Changes Exert upon the Capability of Magnetical Rotation of some Substances.—M. R. Lütge.—This essay is entirely of a mathematico-physical nature, and there belong to it a series of engravings, which render the paper not well suitable for abstraction.

Application of a Steel Magnet, armed with a Wire Spiral, to the Dynamo-Electrical Machine.—Dr. Sinsteden.

Improved Arrangement of Leclanché's Element, and a New Self-Acting Commutator.—Dr. Sinsteden.

On Laxmannite, a New Mineral from Beresowsk.—M. Nordenskjöld.—While making some researches on minerals containing vanquelinite, met with in the large mineralogical museum at Stockholm, the author found a mineral containing a double salt of chromic and phosphoric acids, which mineral he has named laxmannite, in honour of the late Professor Laxmann, who, while making a journey through Siberia, in the year 1773, brought back to Sweden a great number of minerals from the former country and from the Ural mountains. Laxmannite has a specific gravity of 5·77; its colour is dark olive-green; on heating, it loses a very slight amount only of water, fuses before the blowpipe-flame, yielding a blackish-coloured bead. When treated before blowpipe-flame with boracic acid and iron wire, it exhibits the well-known reaction for phosphoric acid; while, on being fused with soda and saltpetre, it exhibits the reaction for chromic acid; it is soluble in nitric and hydrochloric acids, chloride of lead being separated thereby. The formula of this mineral is—

$$(CuO,H_2)_3PO_5+3(PbO,CuO)_3CrO_3;$$

and it consists, in 100 parts, of:—Oxide of lead, 61·48; oxide of copper, 13·13; chromic acid, 16·57; phosphoric acid, 7·83; water, 0·99.

Behaviour of the Iodates and Periodates when Submitted to Heat, and the Formation of the latter from Iodides by means of Peroxides.—M. C. Rammelsberg.—The author first points out a very remarkable difference between the iodate of potassa and the iodate of soda; the former salt, when heated, yields oxygen and iodide of potassium; the latter salt crystallises, containing 8·33 per cent of water, which is driven off at 150°. Various experimenters have stated that this salt always loses iodine when heated; others, again, have denied this. The author finds that, unless the iodate of soda is, previous to being heated, mixed with carbonate of soda, iodine is always set free. As regards the periodates, the author has submitted a number of them to properly-defined higher temperatures, and found that periodate of potassa remains unchanged, even at 200°, but at 300° it is entirely changed into iodate of potassa. The periodate of silver changes, at 175°, into iodate of silver; normal periodate of ammonia detonates on being strongly heated, yielding iodine, nitrogen, oxygen, ammonia, and water. The author has devoted a large portion of this paper to a record of his experiments on the action of iodine upon baryta and the peroxide of barium. Curiously enough, these researches have brought to light the fact that pure baryta is by no means so readily obtained as one might feel inclined to imagine, even though the product of the ignition of nitrate of baryta contained only very minute traces of silica and alumina. The author found that there is about 3 per cent deficiency therein, for, instead of finding Ba 89·54 per cent, he found Ba 86·36 per cent, and even less; and he is inclined to assume the existence of a compound Ba_3O_4; on treating baryta with iodine at higher temperature, compounds were obtained consisting, in 100 parts, of:—Ba, 58·6, I, 32·0; Ba, 56·8, I, 34·2; Ba, 57·0, I, 33·8. These compounds all contain oxygen, and the author gives the formula $Ba_3I_2O_4$. Peroxide of barium behaves in a similar manner with iodine.

Formation and some of the Reactions of the Periodates.—M. Philipp.—This paper is a lengthy essay on this subject, and too full of formulæ to admit of useful abstraction.

On the Krähenberg Meteorite, fallen on the 5th of May, 1869.—M. vom Rath.—It appears that, on the date just alluded to, there fell, at a small village in the Bavarian palatinate, near to Deux-Ponts, a meteoric stone, accompanied by a strong detonation. The author describes this stone at length, and also describes his method of analysis of this stone. In 100 parts, it consists of:—Chromate of iron, 0·94; sulphur, 2·25; iron, 3·47; silica, 43·29; alumina, 0·63; magnesia, 25·32; lime, 2·01; protoxide of iron, 21·06; protoxide of manganese, a trace; soda, 1·03. The specific gravity of this stone is 3·4975 at 18°. The analysis just quoted has been made after a portion of the pulverised stone had been repeatedly treated by means of a magnet to extract metallic iron and nickel; the powder thus separated by the magnet was found to consist, in 100 parts, of—Iron, 84·7; nickel, 15·3. The weight of the entire meteorite was found to be about 30 lbs.

Bulletin Mensuel de la Societé Chimique de Paris, July, 1869.

This periodical contains the *procès verbaux* of the meetings of this Society, held on the 7th and 21st of May last, from which we learn that M. Silva described—

Some Compounds of Isopropyl.—The valerianate of isopropyl boils at 142°; its specific gravity, at 0°, is 0·870; and its vapour density 5·04. The author has tried to prepare trisisopropylamine; he obtained, however, a liquid exhibiting a strongly alkaline reaction, which distils over between 80° and 120°, and which the author thinks is a mixture of di- and tris-isopropylamine. By making butyrate of silver act upon iodide of isopropyl, the author obtained the butyrate of isopropyl ether, $C_4H_7O_2C_3H_7$, boiling at 128°, under a pressure of 755 m.m. The specific gravity of this fluid, at 0°, is 0·8787; its vapour density, as found by experiment, is 4·730. By causing nascent hydrogen to act upon the monochlorhydrine of the amyl-glycol, the author has obtained a product very much resembling amylic alcohol, as was discovered by analysis.

Synthesis of Glucosides.—M. Schutzenberger has tried to effect this by boiling a solution of *saligénine sodée* in benzine with triacetic glucose, which is slightly soluble in that liquid; and, by evaporating the filtrate on a water-bath, a substance was obtained which is viscous at 100° and solid when cold. This compound answers the characters of the glucosides; it is split up into glucose and salicetine, yielding then, also, acetic acid. This glucose is, however, a modification of that substance known as glucosane; its reducing power is less strong than that of ordinary glucose. The residue insoluble in benzine is entirely soluble in water, with the exception of a small quantity of resinous matter; the aqueous solution yields to ether a crystallisable compound, which possesses all the characteristics, also, of a glucoside, but does not contain acetic acid; its composition is $3C_{14}H_{22}O_{11},C_6H_9O_9$.

M. Vogt stated that, while treating the chlorobenzylsulphate and chlorotolylsulphate of potassium with fusing caustic potassa, he has obtained salicylic and cresotic acids.

The following original papers are contained in this number of the above-named periodical:—

Immediate Analysis of the Divers Varieties of Carbon.—M. Berthelot.—We published in full the contents of this paper some time ago.

Comparison between the Saline Constituents of the Grease of Sheep's Wool and the Human Perspiration.—M. S. Cloëz.—In this elaborate paper, the author first reviews the researches of M. Vanquelin and M. Chevreul on this subject; he then briefly refers to M. Evrard's patent, for extracting, from the grease of sheep's wool, carbonate of potassa, which process has been brought to perfection by MM. Maumené and Rogelet, and is carried on on the large scale with success. The two last-named gentlemen, having published some scientific researches on this matter, have come to the conclusion that pure grease of sheep's wool was devoid of soda or salts of this alkali. The author of this paper proves, by a series of analyses, that although in the grease of sheep's wool potassa salts prevail, the salts of soda are not altogether absent. As instances of the composition of the saline constituents of this material, we quote, out of the large number of analyses, a couple of instances:—Grease from sheep's wool taken from animals in pasturage near the sea contained saline matter, in 100 parts, composed of—Carbonate of potassa, 84·80; sulphate of soda, 4·65; chloride of sodium, 10·45. Another sample contained, in 100 parts—Carbonate of potassa, 87·27; sulphate of potassa, 3·59; sulphate of soda, 0·68; chloride of sodium, 8·27. The saline constituents of human perspiration the author found to contain:—Carbonate of potassa, 31·82; sulphate of potassa, 11·76; chloride of potassium, 16·02; chloride of sodium, 38·54.

Relative Proportion of Alkalies found in the Ash of Divers Plants.—M. Cloëz.—This paper is a valuable addition to the methods of ash analysis of plants; but the author chiefly desires to call attention to facts observed already by the late MM. Ingenhousz, Senebier, and Johnston—namely, that the same plants grown near the sea, and at remote distances therefrom, alter their saline constituents, so that, while growing near the sea, soda prevails, as a rule, over potassa, the reverse being the case while the same plant vegetates at a distance more or less remote from the sea; of this fact, some instances are given in this paper. The relation of the soda to the potassa of the ash of *Crambe maritima*, when grown near the sea, was as 960 to 1000; when grown at Paris, as 89 to 1000. The relation of soda to potassa in the ash of black mustard seed grown near the sea was as 200 to 1000, while when grown at Paris, it was as 96 to 1000.

Supersaturation and Dissolution.—M. Lecocq de Boisbaudran.—This paper is a critical review of a paper published in the *Comptes Rendus*, and is not well suited for abstraction.

On Nucitannic Acid.—Dr. Phipson.—The author says that he has discovered, in the epispermium of walnuts, a peculiar kind of tannin, to which he has given the name of nucitannic acid or nucitannin. It is soluble in water and in alcohol; is precipitated by subacetate of lead; while its most remarkable property is that, when boiled with dilute acids, it is split up into glucose, and a reddish-coloured substance, called by author *rothic acid*, since it has acid properties and is soluble in ammonia and alcohol. The nucitannic acid is accompanied by ellagic and gallic acids, which interfere, the author says, with the purifying of the nucitannic acid; about the latter, and about rothic acid, the author promises further communications when his researches shall be complete.

Chemisches Centralblatt, No. 26, June 30, 1869.

This number does not contain any original papers, and the whole of its contents have been noticed by us previously from the originals.

Moniteur Scientifique, No. 302, July 15, 1869.

This paper contains a very lengthy essay on—

Designolle's Gunpowder.—M. Jouglet.—The paper is evidently written with the view to bring, if possible, into general use a powder containing picrates, in addition to nitrate of potassa. The paper is too much an essay written for artillery purposes to render it peculiarly suitable for abstraction; but, incidentally, the author speaks of nitro-glycerine, and, while on this subject, he positively asserts that nitro-glycerine, even when well and carefully made, is spontaneously altered by keeping, becoming acid, and then disengaging gas. This the author asserts is the true clue to the fearful explosions now and then witnessed with this material; and he concludes that if it is to be used at all, it should be made on the spot where it is wanted, and only in such quantities as may be required for blasting during one, or at most two days before.

Among the specifications of French patents, we notice the patent granted to M. Collas, for the—

Application of Phosphate of Lime for Dyeing and Calico Printing.—The author calls attention to the fact that phosphate of lime yields, with various vegetable colours, lakes which are different from those obtained with alumina; that the oxides of copper and cobalt yield, with the freshly-precipitated phosphate of lime, blue-coloured lakes, which greatly surpass, in richness of colour, Thénard's and other blues. The principle of this patent has been long enough known, and, as well remarked by the editor of this paper, it is very questionable whether this matter should be subject to any patent at all.

New Kind of Heating Apparatus for Chemical Laboratories. M. E. Kopp.—This is a rather lengthy description of a complicated set of apparatus intended for heating the laboratory in winter, and, at the same time, supplying at all times a drying stove for filters, &c. The paper describes two kinds of apparatus, in one of which heated air, while in the other steam is applied. It does not, however, appear, from the description, that anything decidedly good is effected by these apparatus, which, from the complicity of construction, cannot but be very expensive; moreover, to be well and readily understood, this paper ought to have been accompanied by a woodcut.

Tinning by the Moist Way.—Dr. Hillier.—It is a well-known fact that, when it is desirable to cover metals, especially brass or copper, with a strongly-adhering coating of tin, this is usually effected by boiling the articles to be thus coated with an aqueous fluid, to which is added cream of tartar, crystallised protochloride of tin, and some lumps of pure metallic tin. The author states that, instead of this mixture, he uses, with very good success, a solution of 1 part of protochloride of tin in 10 parts of water, to which he next adds a solution of 2 parts of caustic soda in 20 parts of water; the mixture becomes turbid, but this does not affect the tinning operation, which is effected by heating the objects to be tinned in this fluid, care being taken, at the same time, to place in the liquid a piece of perforated block-tin plate, and to stir up the fluid during the tinning with a rod of zinc.

Annales des Mines, No. 2, 1869.

This periodical contains the following original papers:—

Some Peculiarities in the Working and Manufacture of Bessemer Steel in Styria and Carinthia.—M. Clérault.—The author of this paper states that, owing to the special advantages due to the excellent iron ores of the countries above named, the manufacture of steel, according to Bessemer's method, is effected with less cost, and yields better results, than is the case elsewhere. The paper is full of practical matters, especially as regards the manufacture of railway iron.

Certain Peculiarities of the Blast Furnaces of the Siegen District.—M. Douville.—The author of this short memoir describes the peculiarities of the blast furnaces established a few years ago in this district of Prussia, wherein, centuries since, iron-works have been in existence, but where only recently the use of coke has been substituted for that of wood. The author's paper is valuable chiefly to ironmasters.

Geological Description and Account of the Mineral Resources of the Canton de Vic Dessos.—M. Mussy.—This is the third and concluding portion of a lengthy monograph exposing the mineral resources, and describing the geology, of that portion of the French Département de l'Ariège, which is contiguous to the republic of Andorra, a country wherein mineral wealth abounds. The paper is an excellent monograph on such a subject.

Journal fur Gasbeleuchtung, June, 1869.

This periodical contains an excellent monograph on photometers and their applications under the title of—

Photometrical Studies.—Dr. Rüdorff.—The author's memoir is too lengthy, and enters too deeply into mathematical details, to render it suitable for abstraction, but it is in every respect, an excellent essay on this subject, and duly applied to practical purposes also.

This number contains the first portion of the report of the annual meeting of German gas engineers, held this year at Cobourg. From this report, we learn that, when hydrate of lime is saturated with carbonic acid, it is yet, provided it be moist, capable of taking up sulphuretted hydrogen very energetically, without thereby simultaneously giving off again carbonic acid gas. One of the members of this Association explains, in a few words, that the removal of sulphur from the oxide of iron used in the purifiers may be advantageously effected by means of quicklime; but no particulars of this process are given.

Les Mondes, July 29, 1869.

We notice from this paper:—

The Champonnois Press.—The name of M. Champonnois as an indefatigable industrial genius, is well and very deservedly known to all acquainted with the manufacture of beet-root sugar especially. We learn, from a short notice in the above-named periodical, that the gentleman just named has succeeded in bring out a very greatly improved press for forcing the saccharine juice out of beet-root pulp so as to obtain a larger quantity of saccharine matter from a given weight of pulp, and also to bring the juice to a state of clearness (that is to say, absence of suspended matter) not hitherto obtained. Experiments with this kind of press, which is worked, moreover, with great economy of power, and yet with enormous force, may be witnessed at the works of MM. J. F. Cail and Co., Quai de Grenelle, Paris, where a large number of these presses have been made to order by beet-root sugar manufacturers, to be applied in the ensuing season.

The Academy of Exact Sciences at Madrid has proposed the following prizes to be distributed in 1871:—To discover the best method of making starch in Spain. Description to be given of the divers varieties of vines cultivated in certain parts of Spain, excepting always the provinces of Asturia, Pontevedro, Biscaya, and Castellon de la Plana. Description to be made of the various rocks met with in one province, at least, of Spain; to indicate their *detritus*, and to point out how this *detritus* contributes to the formation of the agricultural soil in general, and in how far this soil is suitable to the cultivation of trees. The premiums for the approved memoirs are a gold medal and a sum of 1575 francs (£63). The memoirs (written in Spanish, Latin, or French) must be received by the Secretary of the Academy, on or before the 1st of May, 1871.

NOTES AND QUERIES.

Wood-Lice.—I should be very much obliged if any of your correspondents can inform me how to destroy wood-lice in beams, floors, and furniture. It should be something that would not injure or discolour the furniture.—WOOD PRESERVER.

Drying of Animal and Vegetable Substances.—Dr. Müller.—A large glass vessel, a tumbler for instance, is filled for about half its capacity with fused chloride of calcium, and over this a quantity of ether is poured; on the top of the glass vessel another suitable glass or porcelain vessel is placed containing the substance to be dried, and over these vessels, previously placed on a polished glass plate, a bell-jar is placed. The drying takes place in consequence of the fact that the chloride of calcium withdraws water continuously from the ether, and the vapour of the latter, in its turn, withdraws the water from the substances to be dried. It is stated that both animal and vegetable substances dried by this process retain their natural colour, and that animal substances, moreover, retain their elasticity and flexibility.—*Deutsche Ind. Zeitung.*

Dr. Gladstone's Experiments on Light.—Seeing in your report of Dr. Gladstone's Friday evening lecture at the Royal Institution, delivered April 24, 1868, and contained in your impression of June 5, 1868, that he has discovered that, in the case of liquids, $\frac{\mu-1}{d}$ is constant for all temperatures and for all mixtures, with some slight deviations, owing, apparently, to an undiscovered law, you will confer a great favour on me if you will give me the number.—ALEPH.

[Dr. Gladstone informs us that the fact that, in the case of liquids, $\frac{\mu-1}{d}$ is a constant for all temperatures and for mixtures, with some slight deviation, was discovered by Mr. Dale and himself several years ago, and has been verified by some of the German physicists. They (Dr. Gladstone and Mr. Dale) have, however, gone far beyond that now, showing that it is a constant (generally speaking) notwithstanding chemical combination. Dr. Gladstone sent a long paper founded on this to the Royal Society last month.—*Ed.* C. N.]

TO CORRESPONDENTS.

*** Vol. XIX. of THE CHEMICAL NEWS, containing a copious index, is now ready, price 11s. 4d., by post, 11s. 10d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our office, or, if accompanied by a cloth case, for 1s. Subscribers wishing to complete their sets of volumes, are requested to apply to the publisher, who will give them information respecting scarce numbers and volumes. Vol. XX. commenced on July 2nd, and will be complete in twenty-six numbers.

ERRATUM.—In No. 506, p. 68, line 13 from top, *for* "condemning oleography" *read* "commending oleography."

THE CHEMICAL NEWS.

VOL. XX. No. 508.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

EXETER MEETING, AUGUST 18, 1869.

INAUGURAL ADDRESS OF THE PRESIDENT,

GEORGE GABRIEL STOKES, M.A., Sec. R.S.,
D.C.L., Oxon.; LL.D., Dublin;
Fellow of Pembroke College; and Lucasian Professor of Mathematics in the University of Cambridge.

My LORDS, LADIES, AND GENTLEMEN,—

As this is the first time that the British Association for the Advancement of Science has met in the city of Exeter, and it is probable that many now present have never attended a former meeting, I hope the older members of the Association will bear with me if I say a few words in explanation of the objects for which the Association was instituted. In the first place, then, it aims at fulfilling an office which is quite distinct from that of the various scientific societies which are established in different parts of the country. These, for the most part, have for their leading object to make the voluntary labours of isolated workers in science available to the scientific world generally, by receiving, discussing, and publishing the results which they may have obtained. The British Association, on the other hand, aims at giving *a more systematic direction* to scientific inquiry, and that in various ways.

Objects of the Association.—Scientific Reports.

In a rapidly progressing branch of science it is by no means easy to become acquainted with its actual state. The workers in it are scattered throughout the civilised world, and their results are published in a variety of Transactions and scientific periodicals, mixed with other scientific matter. To make oneself, without assistance, well acquainted with what has been done, it is requisite to have access to an extensive library, to be able to read with facility several modern languages, and to have leisure to hunt through the tables of contents, or at least the indices, of a number of serial works. Without such knowledge, there is always the risk that a scientific man may spend his strength in doing over again what has been done already; whereas, with better direction, the same expenditure of time and labour might have resulted in some substantial addition to our knowledge. With a view to meet this difficulty, the British Association has requested individuals who were more specially conversant with particular departments of science, to draw up reports on the present state of our knowledge in, or on the recent progress of, special branches; and the influence of the Association as a public body has been found sufficient to induce a number of scientific men to undertake the great labour of preparing such reports.

By thus ascertaining thoroughly what we already had, what we still wanted was made more clear; and, indeed, it was one special object of the reports I have mentioned to point out what were the more prominent desiderata in the various subjects to which they related. The Association was thus the better enabled to fulfil another of its functions, that of organising means for the prosecution of researches which require co-operation. When the want is within the compass of what can be accomplished by individuals, the demand may be left to create the supply; but it often happens that a research can hardly be carried out without co-operation. It may, for instance, require a combination of the most profound theoretical knowledge with the greatest experimental skill, or an extensive knowledge of very dissimilar branches of science; or, again, the work to be done, though all of one kind, may be of such an extent as to be beyond the power of any one man. In such cases, the limited power of the individual can only be supplemented by the principle of co-operation; and, accordingly, it becomes an important part of the business of the Association to organise committees for the prosecution of special researches. The researches thus undertaken, at the request of the Association, are published at length, along with the reports on the progress of science, in the first part of the annual volume.

Money Grants.

In close connection with the last, must be mentioned another mode in which the Association contributes to the progress of science. Many researches require not only time and thought, but pecuniary outlay; and it would seem hard that scientific men who give their time and labour gratuitously to carrying out such researches should be further obliged to incur an expenditure which they often can ill afford. The Association accordingly makes grants of money to individuals or committees for defraying the expenses of such researches. It appears, from the report which has just been published, that, reckoning up to the year 1867 inclusive, the sum of £29,312 4s. 1d. has been voted by the Association for various scientific objects. Deducting from this the sum of £23 16s., for the balances of grants not wholly expended, which were returned to the Association, we may say that £29,288 8s. 1d. has been expended in the manner indicated. When we remember that these grants were mostly of small amount, and do not include personal expenses, and that very many of the researches undertaken at the request of the Association do not involve money grants at all, we may form some idea of the amount of scientific activity which has been evoked under the auspices of the Association.

Recent Progress of Science.

In the address with which the business of the meeting is opened, it is usual for your President to give some account of the most recent progress of science. The task is by no means an easy one. Few, indeed, are familiar with science in all its branches; and even to one who was, the selection of topics, and the mode of treating them, would still present difficulties. I shall not attempt to give an account of the recent progress of science in general, but shall select, from those branches with which I am more familiar some examples of recent progress, which may, I hope, prove to be of pretty general interest. And even in this, I feel that I shall have to crave your indulgence; for it is hard to be intelligible to some without being wearisome to others.

Astronomy.

Among the various branches of physical science, astronomy occupies, in many respects, a foremost rank. The movements of the heavenly bodies must have occupied the attention and excited the interest of mankind from the earliest ages, and accordingly the first rudiments of the science are lost in the depths of antiquity. The grandeur of the subjects of contemplation which it presents to us have won for it especial favour, and its importance in relation to navigation has caused it to be supported by national resources. Newton's great discovery of universal gravitation raised it from the rank of a science of observation to that of one admitting of the most exact mathematical deduction; and the investigation of the consequences of this law, and the explanation thereby of the lunar and planetary disturbances, have afforded a field for the exercise of the highest mathematical powers on the

Spectrum Observations of the Solar Eclipse.

I turn now to another recent application of spectral analysis. The phenomenon of a total solar eclipse is described by those who have seen it as one of the most imposing that can be witnessed. The rarity of its occurrence and the shortness of its duration afford, however, opportunity for only a hasty study of the phenomena which may then present themselves. Among these, one of the most remarkable, seen indeed before, but first brought prominently into notice by the observers who watched the eclipse of July 7, 1842, consists in a series of mountain-like or cloud-like luminous objects seen outside the dark disk of the moon. These have been seen in subsequent total eclipses, and more specially studied, by means of photography, by Mr. Warren De La Rue in the eclipse of June 18, 1860. The result of the various observations, and especially the study, which could be made at leisure, of the photographs obtained by Mr. De La Rue, proved conclusively that these appendages belong to the sun, not to the moon. The photographs proved further their light to be remarkable for actinic power. Since that time the method of spectral analysis has been elaborated; and it seemed likely that additional information bearing on the nature of these objects might be obtained by the application of the spectroscope. Accordingly various expeditions were equipped for the purpose of observing the total solar eclipse which was to happen on August 17, 1868. In our own country an equatorially mounted telescope, provided with a spectroscope, was procured for the purpose by the Royal Society, which was entrusted to Lieut. (now Captain) Herschel, who was going out to India, one of the countries crossed by the line of the central shadow. Another expedition was organised by the Royal Astronomical Society, under the auspices of Major Tennant, who was foremost in pressing on the attention of scientific men the importance of availing themselves of the opportunity.

Shortly before the conclusion of the meeting of the Association at Norwich last year, the first results of the observations were made known to the meeting through the agency of the electric telegraph. In a telegram sent by M. Janssen to the President of the Royal Society, it was announced that the spectrum of the prominences was very remarkable, showing bright lines, while that of the corona showed none. Brief as the message necessarily was, one point was settled. The prominences could not be clouds in the strict sense of the term, shining either by virtue of their own heat, or by light reflected from below. They must consist of incandescent matter in the *gaseous* form. It appeared, from the more detailed accounts received by post from the various observers, and put together at leisure, that, except in the immediate neighbourhood of the sun, the light of the prominences consisted mainly of three bright lines, of which two coincided with C and F, and the intermediate one nearly, but, as subsequent researches showed, not exactly with D. The bright lines coinciding with C and F indicate the presence of glowing hydrogen. Several of the other lines were identified with those which would be produced by the incandescent vapour of certain other elements.

This is precious information to have gathered during the brief interval of the total phase, and required, on the part of the observers, self-denial in withdrawing the eye from the imposing spectacle of the surrounding scenery, and coolness in proceeding steadily with some definite part of the inquiry, when so many questions crowded for solution, and the fruits of months of preparation were to be reaped in three or four minutes or lost altogether, especially when, as too often happened, the observations were provokingly interrupted by flying clouds.

But, valuable as these observations were, it is obvious that we should have had long to wait before we could have become acquainted with the usual behaviour of these objects, and their possible relation to changes which may be going on at the surface of the sun, if we had been dependent on the rare and brief phenomenon of a total solar eclipse for gathering information respecting them. But how, the question might be asked, shall we ever be able so to subdue the overpowering glare of our great luminary, and the dazzling illumination which it produces in our atmosphere when we look nearly in its direction, as to perceive objects which are comparatively so faint? Here, again, the science of optics comes in aid of astronomy.

Spectral Examination of the Eclipse Prominences.

When a line of light—such as a narrow slit held in front of a luminous object—is viewed through a prism, the light is ordinarily spread out into a coloured band, the length of which may be increased at pleasure by substituting two or more prisms for the single prism. As the total quantity of light is not thereby increased, it is obvious that the intensity of the light of the coloured band will go on decreasing as the length increases. Such is the case with ordinary sources of light—like the flame of a candle, or the sky, which give a continuous spectrum, or one generally continuous, though interrupted by dark bands. But, if the light from the source be homogeneous, consisting, that is, of light of one degree of refrangibility only, the image of the slit will be merely deviated by the prisms, not widened out into a band, and not consequently reduced in intensity by the dispersion. And, if the source of light emit light of both kinds, it will be easily understood that the images of the slit corresponding to light of any definite refrangibilities which the mixture may contain will stand out, by their superior intensity, on the weaker ground of the continuous spectrum.

Preparations for observations of the kind had long been in progress in the hands of our countryman Mr. Lockyer. His first attempts were unsuccessful; but, undismayed by failure, he ordered the construction of a new spectroscope of superior power, in which he was aided by a grant from the sum placed annually by Parliament at the disposal of the Royal Society for scientific purposes. The execution of this instrument was delayed by what proved to be the last illness of the eminent optician to whom it was entrusted (the late Mr. Cooke); but, when at last the instrument was placed in his hands, Mr. Lockyer was not long in discovering the object of his two years' search. On the 20th of October last year, in examining the space immediately surrounding the edge of the solar disk, he obtained evidence, by the occurrence of a bright line in the spectrum, that his slit was on the image of one of those prominences the nature of which had so long been an enigma. It further appeared, from an observation made on November 5th (as, indeed, might be expected from the photographs of Mr. De La Rue, and the descriptions of those who had observed total solar eclipses), that the prominences were merely elevated portions of an extensive luminous stratum of the same general character, which, now that the necessity of the interposition of the moon was dispensed with, could be traced completely round the sun. Notices of this discovery were received from the author by the Royal Society on October 21st and November 3rd, and the former was almost immediately published in No. 105 of the "Proceedings." These were shortly afterwards followed by a fuller paper on the same subject.

Meanwhile, the same thing had been independently observed in another part of the world. After having observed the remarkable spectrum of the prominences during the total eclipse, it occurred to M. Janssen that the same method might allow the prominences to be detected at any time; and, on trial, he succeeded in detecting them the very day after the eclipse. The results of his observations were sent by post, and were received shortly after the account of Mr. Lockyer's discovery had been communicated by Mr. De La Rue to the French Academy.

In the way hitherto described, a prominence is not seen as a whole, but the observer knows when its image is intercepted by the slit; and, by varying a little the position of the slit, a series of sections of the prominence

are obtained, by putting which together the form of the prominence is deduced. Shortly after Mr. Lockyer's communication of his discovery, Mr. Huggins, who had been independently engaged in the attempt to render the prominences visible by the aid of the spectroscope, succeeded in seeing a prominence as a whole by somewhat widening the slit, and using a red glass to diminish the glare of the light admitted by the slit, the prominence being seen by means of the c line in the red. Mr. Lockyer had a design for seeing the prominences as a whole by giving the slit a rapid motion of small extent; but this proved to be superfluous, and they are now habitually seen with their actual forms. Nor is our power of observing them restricted to those which are so situated that they are seen by projection outside the sun's limb; such is the power of the spectroscopic method of observation that it has enabled Mr. Lockyer and others to observe them right on the disk of the sun—an important step for connecting them with other solar phenomena.

One of the most striking results of the habitual study of these prominences is the evidence they afford of the stupendous changes which are going on in the central body of our system. Prominences, the heights of which are to be measured by thousands and tens of thousands of miles, appear and disappear in the course of some minutes. And a study of certain minute changes of position in the bright line F, which receive a simple and natural explanation by referring them to proper motion in the glowing gas by which that line is produced, and which we see no other way of accounting for, have led Mr. Lockyer to conclude that the gas in question is sometimes travelling with velocities comparable with that of the earth in its orbit. Moreover, these exhibitions of intense action are frequently found to be intimately connected with the spots, and can hardly fail to throw light on the disputed question of their formation. Nor are chemical composition and proper motion the only physical conditions of the gas which are accessible to spectral analysis. By comparing the breadth of the bright bands (for, though narrow, they are not mere lines) seen in the prominences with those observed in the spectrum of hydrogen rendered incandescent under different physical conditions, Dr. Frankland and Mr. Lockyer have deduced conclusions respecting the pressure to which the gas is subject in the neighbourhood of the sun. I am happy to say that Mr. Lockyer has consented to deliver a discourse during our meeting, in which the whole subject will doubtless be fully explained.

The Great Southern Telescope.

I have dwelt, perhaps, too long on this topic, and I cannot help fearing that I may have been tedious to the many scientific men to whom the subject is already perfectly familiar; yet the contemplations which it opens out to us are so exalted, and the proof which it affords of what can be accomplished by the union of different branches of science is so striking, that I hope I may be pardoned for occupying your time. I cannot, however, leave the subject of astronomy without congratulating the Association on the accomplishment of an object which originated with it, and in the promotion of which it formerly took an active part. It was at the meeting of the Association at Birmingham in 1849, under the presidency of the Rev. Dr. Robinson, that a resolution was passed for making an application to Her Majesty's Government to establish a reflector of not less than 3 feet aperture at the Cape of Good Hope, and to make such additions to the staff of that observatory as might be necessary for its effectual working. This resolution met with the hearty concurrence of the President of the Council of the Royal Society, who suggested that the precise locality in the Southern Hemisphere where the telescope should be erected had best be left an open question. This modification having been adopted by your Council, the application was presented to Earl Russell, then First Lord of the Treasury, by representatives of both bodies early in 1850. A reply was received from Government to the effect that, though they agreed with the Association as to the interest which attached itself to the inquiry, yet there was so much difficulty attending the arrangements that they were not prepared to take any steps without much further inquiry. This reply was considered so far favourable as not to forbid the hope of success if the application were renewed on a suitable opportunity. The subject was again brought before the Association, by Colonel (now General Sir Edward) Sabine, in his opening address as President at the Belfast meeting in 1852. The result was that the matter was again brought before Government by a Committee of the British Association acting in conjunction with a Committee of the Royal Society, by means of an application made to the Earl of Aberdeen. By this time the country was engaged in the Russian war, in consequence of which it was replied, no funds could then be spared; but a promise was given that, when the crisis then impending was past, the matter should be taken up—a promise which the retirement from office and subsequent death of Lord Aberdeen rendered of no avail.

But, though failing in its immediate object, the action of the British Association in this matter has not remained fruitless. A few years later, the subject was warmly taken up at Melbourne, and, after preliminary correspondence between the Board of Visitors of the Melbourne Observatory and the President and Council of the Royal Society, and the appointment by the latter body of a committee to consider and report on the subject, in April, 1864, a proposition was made to the Colonial Legislature for a grant of £5000 for the construction of a telescope, and was acceded to. Not to weary you with details, I will merely say that the telescope has been constructed by Mr. Grubb, of Dublin, and is now erected at Melbourne, and in the hands of Mr. Le Sueur, who has been appointed to use it. It is a reflector of 4 feet aperture, of the Cassegrain construction, equatorially mounted, and provided with a clock-movement. Before its shipment, it was inspected in Dublin by the committee appointed by the Royal Society to consider the best mode of carrying out the object for which the vote was made by the Melbourne Legislature; and the committee speak in the highest terms of its contrivance and execution. We may expect before long to get a first instalment of the results obtained by a scrutiny of the southern heavens with an instrument far more powerful than any that has hitherto been applied to them—results which will, at the same time, add to our existing knowledge, and redound to the honour of the colony by whose liberality this long-cherished object has at last been effected.

(To be continued.)

Section B.

ADDRESS
TO THE
CHEMICAL SECTION.

AUGUST 19, 1869.

By Dr. DEBUS, F.R.S., President.

I BELIEVE it has been the custom with many of my predecessors in this office to place before the members of the British Association a Report of the progress of Chemistry during the year preceding their election. In attempting to follow their example, I soon found that it would be impossible for me, without making too great a demand upon your time, to give even a bare outline of the more important chemical work done during the year. A science, the report of whose yearly advances fills about 1000 large octavo pages, cannot, by any powers of mine, have its progress chronicled in an address of half an hour's duration. The best course open to me under such circumsta-

is to direct your attention to the ideas which at present guide chemists in their researches, to place in a clear light the objects they are striving to attain, and to indicate the direction of scientific thought of our time. To do this is by no means an easy task; for the more manifold and diversified the objects of a science become—the more numerous and extensive its relations with other branches of knowledge, the more difficult it becomes to draw a picture of its actual condition.

It is always an excellent recommendation to a theory or hypothesis when, amongst the cultivators of the science to which it pertains, very little difference of opinion exists as regards its admissibility and scientific value. This is, in a high degree, the case with regard to the atomic theory. The vast majority of chemists, I believe, accept this theory as the most suitable exponent of the fundamental truths of their science; and certainly, if the quality of the tree may be judged by its fruit, there is no other view which furnishes a clearer image to our minds of the chemical constitution of bodies, and, at the same time, conducts to the discovery of so many important facts and relations. By Dalton's profound hypothesis, all bodies are supposed to be composed of atoms of infinitely small dimensions. But these atoms are supposed not to be single; two or more of them are held together by certain forces, and thus constitute what is called a molecule. One atom of carbon, one atom of calcium, and three atoms of oxygen, joined together by the force called chemical affinity, constitute a molecule of carbonate of lime. Vast numbers of such molecules, bound to each other by the force of cohesion, form a visible piece of chalk. If a chemist wishes to examine a body, his first endeavour is to ascertain of what sort of atoms the body is formed. This is a mere matter of experiment. He next determines how many of such atoms are contained in each molecule of the body, and, finally, he ascertains how these atoms are arranged, or, more correctly, combined within the molecule; for it is quite clear that a substance like saltpetre, which contains one atom of nitrogen, one of potassium, and three of oxygen, may have these atoms arranged in very different manners, and still have the same composition. We might assume the potassium and nitrogen in more intimate union, nearer to each other than they are to oxygen, or we might consider nitrogen and oxygen more closely packed together, and, so to speak, attached as a whole to the potassium; in both cases, saltpetre would have in each molecule the same number of atoms, and the weight of the molecule would be the same. The three determinations just mentioned are of fundamental importance to the chemist; not that such inquiries are the only ones which interest him, for we shall, in the sequel, notice others of almost equal importance.

Nor must it be supposed that questions of this nature are of quite a modern date; for Leucippus, 500 B.C., appears to have sought to explain the nature of things, by the assumption that they are formed by the union of small particles, which latter received the name of atoms from Epicurus. It is true the notion of atoms, as conceived by the Grecian philosophers, is not quite the same as ours, but their speculations contain our notions pretty much in the same way as the acorn contains the oak-tree.

The determination of the quality of the atoms in a molecule, or the analysis of the latter, has not undergone many changes during the last few years; and the same may be said about the finding of the relative weight of a molecule, or the determination of the number of atoms which are contained in it. With regard to the latter point, however, it may be mentioned that Avogadro's hypothesis, according to which equal volumes of gaseous substances, measured at the same temperature and pressure, contain the same number of molecules, guides us chiefly in assigning to each molecule its relative weight and its number of atoms; this hypothesis has won more and more the confidence of chemists, and it is now admitted to hold good in nearly all well-examined cases.

Our views relative to the combinations of atoms in molecules, and our methods of ascertaining this arrangement, have, however, undergone great alterations, and received great additions, during the last ten or fifteen years. To a consideration of these changes I will now, for a short time, invite your attention. Since our modern views, however, originated, in a great measure, from the study of organic bodies, and since the majority of chemists now devote their time and labour thereto, I shall confine my remarks principally to the organic branch of the subject.

Eighteen years ago, Prof. Williamson read before the members of this Association a remarkable paper, which contained the germ of our modern chemical views, and was the cause of many discoveries. He proposed to regard three large classes of bodies, acids, bases, and salts from the same point of view, and to compare their chemical properties with those of one single elected substance. For this term of comparison he chose water. Now water is composed of three atoms—two of hydrogen and one of oxygen. Williamson showed that all oxygen acids—all oxygen bases, and the salts resulting from a combination of the two—can, like water, be considered to be composed of three parts, or radicals, two of the radicals playing the part of the hydrogen atoms in water, and the third that of the atom of oxygen, thus:—

$\left.\begin{matrix}H\\H\end{matrix}\right\}O$	$\left.\begin{matrix}K\\H\end{matrix}\right\}O$	$\left.\begin{matrix}NO\\H\end{matrix}\right\}O$	$\left.\begin{matrix}NO\\K\end{matrix}\right\}O$
Water.	Potassic hydrate.	Hydric nitrite.	Potassic nitrite.

Potassic hydrate is water which has one of its atoms of hydrogen replaced by an atom of potassium; hydric nitrite is water which has one atom of hydrogen replaced by nitric oxide; and potassic nitrite is water with one of its hydrogen atoms replaced by nitric oxide, and the other by potassium. This speculation, as every chemist knows, is well supported by experiments; it embraces three large classes of bodies which, till then, had been considered as distinct. M. Gerhardt, in 1853, extended Williamson's views, by distinguishing two other types of molecular structure, represented, respectively, by hydrogen and ammonia, and succeeded, by help of the radical theory, in arranging the majority of the then known substances under one or the other of the three types already mentioned.

Like every theory which is in harmony with experience, the above considerations led to results of unexpected importance; for it soon became apparent that the radicals which thus replace hydrogen in water are not all of the same chemical value. If we place together the formulæ of hydric nitrite and carbonic acid—

$\left.\begin{matrix}NO\\H\end{matrix}\right\}O$	$CO\}O$
Hydric nitrite.	Carbonic acid.

we perceive, at once, that the atomic group NO has replaced one atom of hydrogen in one molecule of water, and carbonic oxide, CO, two atoms of hydrogen in one molecule of water. Nitric oxide (NO) is, therefore, said to be equivalent to one atom of hydrogen, and carbonic oxide (CO) equivalent to two atoms of hydrogen. The radical of phosphoric acid [PO] is found to be equivalent to three atoms of hydrogen. Professor Odling was one of the first to observe this difference in the equivalence of atoms, and groups of atoms, or compound radicals, as they are termed, a difference which he marks, as shown in the following examples:—

Radicals.			
Equivalent to one atom of hydrogen.		Equivalent to two atoms of hydrogen.	
Nitric oxide	$(NO)'$	Carbonic oxide	$[CO]''$
Methyl	$(CH_3)'$	Methylene	$[CH_2]''$
Ethyl	$(C_2H_5)'$	Ethylene	$[C_2H_4]''$

The notion of equivalence enabled Professor Kekule to form most interesting speculations on the constitution of organic bodies, and to explain the relation between composition and equivalence of such radicals as methyl, CH_3,

ethyl, C_2H_5, methylene, CH_2, ethylene, C_2H_4, and acetylene, C_2H_2.

If from one molecule of marsh gas, CH_4, one atom of hydrogen is abstracted, the residue, CH_3, called methyl, can combine with an atom of hydrogen again, and produce the original marsh-gas molecule. But methyl, instead of combining with an atom of hydrogen, can unite with an atom of chlorine, or an atom of bromine, that is to say, the place of the atom of hydrogen can be taken by an atom of chlorine or bromine. Methyl being thus equivalent to an atom of hydrogen, is said to be monovalent. If from a molecule of marsh-gas two atoms of hydrogen are removed, the residue, CH_2, called methylene, can again unite with two atoms of hydrogen, or, instead of hydrogen, two atoms of chlorine or bromine, and from the compounds CH_4, $CHCl_2$, CH_2, Br_2 respectively. Methylene, therefore, being equivalent to two atoms of hydrogen, is termed divalent. The radical CH, left after the abstraction of three atoms of hydrogen from marsh-gas, is able to re-produce with three atoms of hydrogen one molecule of marsh-gas, or to combine with three atoms of chlorine, and form chloroform, $CHCl_3$. The residue, CH, is thus trivalent or equivalent to three atoms of hydrogen. In the same manner carbon is found to be tetravalent or equivalent to four atoms of hydrogen. But carbon, formen [CH], methylene, CH_2, methyl, CH_3, not only combine with hydrogen, chlorine, or other elements according to their equivalence, but also amongst themselves, and thus produce the so-called hydrocarbons, native as well as artificial. Methyl combines with methyl and produces dimethyl, or better known as ethylic hydride, $CH_3+CH_3=C_2H_6$; methylene combines with methylene, and forms ethylene, $CH_2+CH_2=C_2H_4$. Methylene is divalent, and methyl monavalent; therefore methylene combines with two equivalents of methyl and forms propylic hydride, C_3H_8, $CH_2+2CH_3=C_3H_8$. Six equivalents of formen are supposed to be contained in benzol [C_6H_6], $6CH=C_6H_6$.

What has been said of marsh-gas also applies to ammonia and water. Ammonia, NH_3, minus one atom of hydrogen, forms the monovalent radical, NH_2, minus two atoms of hydrogen, the divalent radical, NH, and nitrogen itself trivalent, that is to say, it can replace three atoms of hydrogen in compounds, or can combine with three atoms of hydrogen. Water minus one atom of hydrogen produces the monovalent radical hydroxyl, HO, and water without both atoms of hydrogen gives us divalent oxygen. These radicals, NH_2, NH, N, HO, and O, can combine with each other, and with methyl, methylene, formen, and carbon respectively in different proportions. Thus methyl, methylene, and hydroxyl are contained in common alcohol. The union of methyl, carbon, oxygen, and hydroxyl gives acetic acid, $C_2H_4O_2$,

$$CH_3+C+O+HO=C_2H_4O_2.$$

Glycocoll is considered as a combination of methylene amidogen [NH_2], carbon, oxygen, and hydroxyl:—

$$CH_2+NH_2+C+O+HO=C_2H_5NO_2=\text{glycocoll.}$$

The radicals C, CH, CH_2, CH_3, HO, O, N, NH, NH_2, and CO are considered to form the proximate constituents of the most important organic compounds. It often happens that, from the union of the same radicals, two or more bodies of the same composition, but differing from one another in properties, result. Glycocoll, as well as glycolamide, contain the radicals methylene, hydroxyl, carbonic oxide, and amidogen, NH_2. In such cases the nature of the compound depends on the arrangement of the radicals, as may be seen by the following formulæ:—

$$CH_2.NH_2.CO.HO = C_2H_5NO_2 = \text{glycocoll,}$$
$$CH_2.HO.CO.NH_2 = C_2H_5NO_2 = \text{glycolamide.}$$

Now, the great problem with whose solutions scientific chemists are occupied is *to determine, first, what sort of radicals of the above nature are contained in a given organic body, and, second, how these radicals are grouped amongst each other.*

There are several ways of solving this problem. The molecule may be built up by placing the radicals which are supposed to exist in it under suitable conditions in contact. Two molecules of iodopropionic acid placed together with metallic silver will lose their iodine, and the residues of the two molecules remain united. A new acid, called adipic acid, is thus formed.

$$\left.\begin{matrix}\text{Iodopropionic}\\ \text{acid}\end{matrix}\right\}\begin{matrix}CO.HO\\ CH_2\\ CH_2I\end{matrix} + Ag = 2AgI + \begin{matrix}COHO\\ CH_2\\ CH_2\\ CH_2\\ CH_2\\ COHO\end{matrix} = \text{adipic acid.}$$
$$\left.\begin{matrix}\text{Iodopropionic}\\ \text{acid}\end{matrix}\right\}\begin{matrix}CH_2I\\ CH_2\\ COHO\end{matrix}$$

We know, therefore, the radicals of adipic acid and their arrangement if we possess the same knowledge with regard to iodopropionic acid.

The above elegant synthesis has lately been performed by Professor Wislicenus of Zurich. M. Berthelot has now succeeded in producing representatives of the principal classes of hydrocarbons from the elements of carbon and hydrogen, and Messrs. Bauer and Versow of Vienna have prepared from amylene, C_5H_{10}, a compound, $C_{10}H_{16}$, which appears to be identical with terebene, a body closely allied to turpentine.

Another way to determine the proximate constituents of molecules is to take the little structures to pieces, and to form a judgment of their constitution from the radicals which thus can be extracted. This plan has been adopted by Mr. Chapman, and described by him at one of our former meetings.

The more common and more reliable method for the determination of the grouping of atoms in molecules is, however, the replacement of one or more of them by atoms of another kind, and the careful examination of the properties of the bodies thus formed. M. Gautier has recently obtained a new substance of the same composition as acetonitrile, which he calls methcarbylamine. According to their formation, acetonitrile, as well as methcarbylamine, can be considered as combinations of cyanogen and methyl = CH_3CN. The two bodies, however, do not possess the same properties. If they are heated with potassic hydrate and water, methcarbylamine produces formic acid and methylia, whereas the same reagents cause acetonitrile to form acetic acid and ammonia. Thus—

$$\underbrace{C_2H_3N}_{\text{Acetonitrile.}} + \underbrace{2H_2O}_{\text{Water.}} = \underbrace{C_2H_4O_2}_{\text{Acetic Acid.}} + NH_3$$

$$\underbrace{C_2H_3N}_{\text{Methcarbylamine.}} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic Acid.}} + \underbrace{N\begin{matrix}CH_3\\H_2\end{matrix}}_{\text{Methylia.}}$$

In the first case, the radical methyl remains after the decomposition in union with carbon, and in the second case in combination with nitrogen. Accordingly, it is supposed that the same arrangement prevails in the undecomposed molecules, and with this supposition all the other properties of methcarbylamine and acetonitrile agree. In symbols these relations are expressed as follows:—

$$N\begin{matrix}C''\\CH_3\end{matrix} = \text{methcarbylamine.}$$
$$N-C_2H_3 = \text{acetonitrile.}$$

This case of isomerism is most interesting, inasmuch as it furnishes a most instructive lesson on the grouping of atoms. The homologous bodies of methcarbylamine in the ethyl and propyl series have also been obtained.

Isomerism, indeed, has received much attention during the last year, and a great many interesting discoveries have resulted. Of these, one more example may be mentioned. We know two compounds of the formula CN_2H_4O—the one is ammonic cyanate, and the other urea. Until recently, only one corresponding sulphur-compound, ammonic sulphocyanate, was known. Professor Reynolds has succeeded in obtaining the true sulphur-urea, a body isomeric to ammonic sulphocyanate.

Thus every year produces results which improve our conceptions of the atomic and molecular constitution of

bodies. And, as our knowledge improves, new questions suggest themselves, and our power over the elements increases. It has already become possible to prepare, in the laboratory, bodies of a very complex character, and which, a few years ago, were only found in the bodies of animals or plants.

Alizarine, the beautiful compound of the madder root, has been obtained, by artificial means, in the course of the year, by MM. Liebermann and Græbe. Results of such a nature render it highly probable that, at no distant period, it will be in our power to render nearly all, if not all, the substances found in plants and animals. Here I must not be misunderstood. Organic structures, such as muscular fibre, or the leaves of a tree, the science of chemistry is incapable of producing; but molecules like those found in a leaf, or in the stem of a tree, will, no doubt, one day be manufactured from their elements.

I must not conclude this address without reference to two or three papers of great importance.

Professor Bunsen, of Heidelberg, has published a paper on the washing of precipitates. Every one acquainted with practical chemistry knows how much time is often lost in waiting for a liquid to pass through a filter. Bunsen found the rate of filtration nearly proportional to the difference between the pressures on the upper and lower surfaces of the liquid. If, accordingly, the funnel be fixed air-tight, by means of a perforated cork, to the neck of a bottle, and the air exhausted in the bottle, the liquid will run faster through the filter in proportion to the diminution of the pressure in the bottle. Comparative experiments, some made according to the old, and others according to the new method, showed that the filtration, washing, and drying of the precipitate, which took seven hours by the old plan, could be performed, by filtration into an exhausted bottle, in thirteen minutes. But a saving of time is not the only advantage of the improved method of collecting and washing precipitates. A more perfect washing, with less water than is required by the common way of proceeding, is by no means the least recommendation of Bunsen's ingenious method.

A very important paper has been published by Professor Liebig, on the improvement of the nourishing qualities of bread. Certain quantities of phosphates and other salts form necessary ingredients of wholesome food. Now, it is well known that most of these salts, which are naturally in wheat, remain with the husk. Liebig proposes to add salts, of a nature similar to those remaining in the husk, to the flour, and, at the same time, to substitute, for the carbonic acid developed by fermentation, gas liberated from iodic carbonate. The bread prepared according to Liebig's recommendation is said to be of excellent quality, and to exceed bread made by the common plan in value.

Mr. Graham, of Her Majesty's Mint, has continued his researches on the absorption of hydrogen by palladium. Palladium appears to be able to absorb more than 900 times its volume of hydrogen, and to form a combination which consists of nearly equal equivalents of the two elements. Hydrogenium, as Mr. Graham calls the combined hydrogen, acts in this case like a metal, and thus the opinion held by some scientific men, that hydrogen constitutes the vapour of a metal, receives confirmation. The specific gravity of hydrogenium, as contained in the alloy, was found to be 1·95. These experiments are remarkable in more than one respect. The palladium which absorbs and combines with the hydrogen, does not change its state of aggregation, but remains solid, and expands, as if it had been heated. The nodules of the palladium have, consequently, changed their relative positions, and combined with hydrogen, whilst the continuity of the metal remained intact.

The last paper to which I have to draw your attention, is to the beautiful paper by Professor Tyndall, on a new method of decomposing gaseous substances by means of light. Tyndall's experiments bring us face to face with the motions of atoms of molecules, and the relation of these motions to chemical decomposition. They will, no doubt, at some future time, furnish valuable materials to chemical dynamics.

ON THE

METHODS OF ANALYSIS

AND THE

COMPOSITION OF VARIOUS CHEMICAL MANUFACTURING PRODUCTS.

By M. GASTON TISSANDIER.

(Continued from p. 76.)

Chlorides of Potassium.

Commercial chlorides of potassium, or muriates of potash, contain sulphates, and frequently alkaline carbonates also; in certain cases a more or less considerable proportion of chloride of sodium is also found in them.

Method of Analysis.—Weigh 25 grammes of the muriate of potash to be tested, and dissolve them in a beaker; filter the solution to separate the insoluble matters, which usually occur only in very small proportion, and dilute it with water to the volume of ½ a litre.

Alkalimetric Standard.—This does not generally exceed 1° or 2°; for obtaining it, decant 100 c.c., corresponding to 5 grammes: ascertaining previously that the solution is alkaline, for it is possible that the muriate may not contain any alkaline carbonates.

Sulphuric Acid.—The sulphuric acid is estimated in 100 c.c. (5 grammes) by means of chloride of barium.

Chlorine.—The estimation of the chlorine is of great importance, and should be rigorously exact: take 10 c.c. of the filtered liquid tared to ½ a litre, and determine the amount of chlorine by means of a standard silver liquid. For greater exactness, it is a good plan to verify this estimation by directly weighing the chloride of silver precipitated in another experiment. Measure 10 c.c. (0·50 gr.) of the solution of muriate, and transfer them by means of a pipette into a beaker holding 500 c.c.; add a large quantity of boiling water, acidulate it with pure nitric acid, and precipitate the chlorine by a slight excess of nitrate of silver. The estimation previously made by means of the standard solution allows the quantity of nitrate of silver required to be calculated, so that the excess may not be great. The precipitate is well stirred with a glass rod, and the warm liquid settles so well that it is possible to wash the precipitate of chloride of silver by decantation with boiling water. When the washing water is not clouded on the addition of a drop of chlorhydric acid, it is thrown on a small filter, left to drain, and dried at 100°.

The desiccated precipitate is detached from the filter, which is calcined in a small tared porcelain capsule, and when the paper is burnt, the chloride of silver precipitate must be added and partially melted; it is then cooled, and the capsule weighed together with the chloride of silver; the weight of the precipitate is thus obtained by difference. The chloride of silver adheres closely to the capsule. In order to remove it, throw the whole into a glass, and place on it a piece of zinc, sulphuric acid, and water; the chloride of silver, partially reduced, will then separate from the capsule.

Potassium.—The estimation of potassium is effected in the same way as in the case of crude salts (see Chemical News, vol. xx., p. 73), by means of bichloride of platinum, working upon 10 c.c. (0·50 grms.)

Water.—The proportion of water is ascertained by heating, in a platinum crucible, a given weight of the muriate to be tested. A closed tube is still better, as it

allows the loss from projections arising from the deflagration of the salt to be more easily avoided.

Calculation of the Analysis.—Part of the estimated potassium is combined with the sulphuric acid contained in the sulphate. If the excess of potassium is sufficient to combine with the whole of the chlorine, the latter is transformed into chloride of potassium; if not, the quantity of chlorine necessary to form chloride of potassium with the remaining potassium is calculated, and the excess of chlorine reckoned as chloride of sodium.

Composition of Commercial Muriates.

1. *Muriates containing Alkaline Carbonates.*

Substances estimated.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Moisture	4·27	6·68	5·00	1·01	1·38	3·69	6·35	15·06
Insoluble matter	0·32	0·22	0·10	0·18	0·28	0·41	0·90	0·09
Sulphate of potash	12·31	9·45	12·31	5·50	4·01	14·18	11·81	11·62
Chloride of potassium	79·80	80·00	77·20	92·39	93·52	80·92	75·01	59·41
Carbonate of potash	1·00	3·25	3·10	0·92	0·61	0·49	3·28	13·82
Carbonate of soda	2·10	—	2·01		—	—	2·13	
Non-estimated and loss	0·20	0·40	0·28	—	0·20	0·31	0·52	—
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
	MM. Vorster and Grüneberg, at Cologne.				M. P. Rohée, at Bordeaux.		M. A. Lefebvre, at Corbehem, near Douai.	

2. *Muriates containing Chloride of Sodium.*

Matters estimated.	I.	II.
Moisture	3·09	1·50
Insoluble substances	0·11	0·20
Sulphate of potash	0·81	4·61
Chloride of potassium	80·15	78·40
Chloride of sodium	15·01	14·09
Carbonate of soda	0·72	1·12
Non-estimated and loss	0·11	0·08
Total	100·00	100·00
	MM. Campion and Theroulde, at Granville.	

NB. These sulphates proceed from a manufacture of iodine from kelp.

3. *Muriates Containing neither Chloride of Sodium nor Carbonates.*

Substances estimated.	I.	II.	III.
Moisture	1·20	3·63	3·50
Insoluble matter	0·31	0·21	0·30
Sulphate of potash	6·90	11·86	4·55
Chloride of potassium	91·50	84·20	91·65
Non-estimated and loss	0·09	0·10	—
Total	100·00	100·00	100·00
		M. Paisant, jun., at Pont-l'Abbé (Finisterre).	

Chloride of potassium is obtained, as has been shown, from the beet-root salts; it is also extracted in abundant quantities from the ash of seaweed. The newly-discovered deposit at Stassfurt yields considerable quantities; and large kidney-shaped pieces of pure chloride of potassium have been found in abundance in the midst of that vast salt mass. We have repeatedly analysed this natural chloride of potassium (called by the Germans sylvin), and have never discovered more than 1-10th of foreign matter. Every sample which we examined contained from 80 to 99 per cent of chloride of potassium. This is a highly important fact; and it is well known that the influence of the exportation of the Stassfurt products is already making itself felt in the manufacture of potashes.

(To be continued).

The Laboratory of the London Institution.—We understand that Professor Wanklyn has recently been elected a corresponding member of the Munich Academy of Science.

NOTICES OF BOOKS.

Exeter Change, for the British Lions. Edited by Snug the Joiner. London: B. Pardon and Son, Paternoster Row. 1869.

The British Association for the Advancement of Science meets this year, as all the world knows, at Exeter. Exeter Change, as all the world—specially the younger portion of it—does *not* know, was once one of the sights of London; for therein were housed the British Lions which had whilom dwelt in the Tower of London, and, symbolising the sovereignty of this realm, had been considered necessary appurtenances of Royalty. "Exeter Change," says the editor of the pamphlet before us, "has disappeared, and the ground hallowed by memories of the caged lions; and the solitary beadle is now occupied by the Gaiety Theatre. Need I add that my title-page is deeply significant. You British Lions have now an Exeter Change productive of gaiety."

"Exeter Change" is not a satire; it has nothing of the lampoon about it; the sarcastic Roman Pasquino would scarcely allow it to be called a pasquinade; there is nothing in it the least bitter or spiteful, nothing that smacks of the *Tomahawk*, or *Queen's Messenger*. The mention of an individual is generally accompanied by his laudation, or, if the reverse, the censure is no more than the most harmless "chaff." What, then, shall we call it? A parody? Scarcely. A squib? By no means. A burlesque? This is nearer the mark; particularly if we may trace the word through the Italian *burlesco*, and the Low Latin *burleschus*, to the classical *burra*, as Mr. Donald tells us; but Ainsworth is silent about *burra*, and approaches it no more nearly than *bura*, which signifies "the hinder part of a plough," and is scarcely appropriate. What, then, remains to us? A travesty? That will do better. "Exeter Change" is a sort of travesty; or, if the reader pleases, he may find in it just a *soupçon* of several of the above forms of composition.

Having defined our work, let us look more closely into it. In the "Prologue," the editor greets the various presidents of sections and learned bodies of the British Association, and states the object and aim of his work. This is followed by a "History of the Association," written in the exact and somewhat prosaic style of certain students of the Buckle School. Then comes the "Wail of the Mathematician," a poem in imitation of "Locksley Hall," which is clever, and shall speak for itself—albeit in a somewhat *staccato* manner. The mathematician here describes the progress of his courtship:—

"Once about the beach we wandered, spooning in a way sublime,
While the dreary tales of Science were reserved for future time;

When geologists before us on contorted strata prosed,
We were sure to find a seaweed in a place not much exposed."

. . . . . .

"At the time when Dr. Hooker the Darwinian standard raised;
At the time when sharp Miss Becker got herself unduly praised;
At the time when Father Secchi fraternised with prelates grave;
Then it was that I discovered I was simply Kitty's slave."

Determining to discard this fickle Kitty, the mathematician tries to find some strong-minded woman—

"Iron-visaged, tall, snd skinny, she the bluest of the blues,
Shall with potent mathematics my domestic life suffuse.
Dingy black shall be her costume: pins shall take the place of hooks:
And her hair, close-cropped, shall startle followers of fashion books."

The poem is followed by a long article on "The Development Hypothesis," a travesty of some recent animadversions of the German anti-Darwinites. "On some Recent Spectral Observations" follows this. Herein a man is supposed to fall asleep in his library, and to see a vision of the various authors of the books around him, and to hold a short conversation with them: the following extract is taken from the concluding portions:—

"But there now arose such a clamour that I could not hear myself speak. Albertus Magnus *would* keep striking Avicenna with a crozier; Cardinal Bellarmine threw his hat at Galileo; Abelard tripped up William of Champeaux; the pretty little Heloise flirted with Peter of Cluny; while a host of Plenists, headed by Father Linus, were having a set fight with a host of Vacuists, headed by Robert Boyle."

Next we have "Mercurius Rex"—a chemical ode. Recitative and air, with accompaniments of Maëlzel's metronome, contrabassos in F in altissimo, Helmholtz's double syren, and the tibia pastorale.

In the next article—"On the Alcoholic Compound termed Punch," by John T—nd—ll, LL.D., F.R.S.—we have a capital imitation of the style of a certain eminent lecturer and physicist. Let us content ourselves with the last two paragraphs—

"Experiment has proved that the juice of three or four lemons, and three-quarters of a pound of loaf-sugar dissolved in about three pints of boiling water, give saporous waves which strike the palate at such intervals that the thrilling acidity of the lemon-juice and the cloying sweetness of the sugar are no longer distinguishable. We have, in fact, a harmony of saporific notes. The pitch, however, is too low, and to heighten it, we infuse in the boiling water the fragrant yellow rind of one lemon. Here we might pause, if the soul of man craved no higher result than lemonade. But to obtain the culminating saporosity of punch, we must dash into the bowl, at least, a pint of rum and nearly the same volume of brandy. The molecules of alcohol, sugar, and citric acid collide, and an entirely new series of vibrations are produced—tremors to which the dullest palate is attuned.

"In Punch, then, we have rhythm within rhythm, and all that philosophy can do is to take kindly to its subtle harmonies. It will depend in some measure upon previous habits, whether the punch when mixed will be taken in excess or in moderation. It may become a dangerous ally of gravity and bring a sentient being to the gutter. But, on the other hand, it may become the potent inner stimulus of a noble outward life."

The remainder of the pamphlet is filled with shorter articles:—An "Alphabet for Young Associates;" "Rejected Addresses," giving a list of certain supposititious papers rejected by different Sections;" Advice "To the Dyspeptic Members of the Association," containing a *menu* in which we notice "Goujon sauté en l'eau froide;" "Poulet pansu;" "Porc à la trichine;" "Xéres de Hamburg nouveau et brûlant;" and "Vin d'Oporto des environs de Spital-fields."

"Eozöon Canadense: a lay of Chivalry from Section C" is a poem of twenty-one stanzas; "What will they do with it?" an account of a meeting in the Albert Hall of Arts and Sciences" in 1872, when a grand difficulty has arisen as to what use the Hall shall be applied to, and various *savants* express their various opinions. Then we have a letter from Francis Bacon, headed "Elysian Fields, August 15th, 1869," in which, in the quaint English of the early part of the seventeenth century, Bacon refers to his treatise "Nova Atlantis," and shows that he therein shadowed forth such an Association of the learned as we now have in the British Association for the Advancement of Science.

Altogether, "Exeter Change" is very readable. There is not much wit in it, but it is pleasant and lively, and never gross or coarse, nor do we detect any *doubles entendres*, too often the vehicle for raillery and sarcasm, and sometimes for what is worse. It is evidently the work of young writers; and it is equally evident that the matter has been struck off rapidly, without much elaboration, and this we consider an advantage, for, by the means, we get fresh, budding ideas, in the place of garish and dressed-up piracies. We wish Snug the Joiner, and his colleagues, Peter Quince and Nick Bottom, every success; and we commend their trim little work, not alone to members of the Association, but to their scientific *confréres* who have not journeyed to Exeter.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

The Journal of the Franklin Institute, June, 1869.

A large portion of this excellent periodical is devoted to engineering facts. Among the original communications relating to chemistry we find:—

Sugar and Starch from Sweet Potatoes.—M. H. Bartol presented, at the last meeting of this Institute, samples of sugar and starch, and the following analysis made in November last, from the juice of North Carolina sweet potatoes (per cent):—Sugar, 10·50; starch, 6·00; various salts, 1·17; gum, &c., 0·33; water, 82·00. By the use of powerful presses, 90 per cent of the weight of the potato can be obtained in juice; the density of this juice is 10° Beaumé=1·075 sp. gr. These potatoes, the author says, will yield 6·18 per cent of sugar and 5 per cent of starch; but, by improved culture, as evidenced in Europe in the instance of beet-root, this quantity may be largely increased.

Tin in Missouri.—M. Williams.—This gentleman, in a note addressed to the editor of the above periodical, states that the granitic rocks of south-east Missouri are all more or less charged with stannic acid, so that there is a fair prospect of obtaining tin ore in quantity in that country.

The larger number of papers of this number relate to engineering and astronomy, rather than to chemistry or sciences allied therewith

American Journal of Pharmacy, July, 1869.

This periodical contains a very large amount of excellent matter, but most of it belongs too strictly to pharmacy to be suited for our pages We abstract the following papers:—

Bicarbonate of Ammonia as a Pharmaceutical Preparation.—W. Procter, jun.—The author begins by stating that he has used this salt as an antacid, instead of bicarbonate of soda, above which it is preferable, owing, also, to its somewhat stimulating powers. As to the formation of this salt, the author says—It is well known to druggists that considerable quantities of this salt are formed on the sides of casks in which carbonate of ammonia is imported, and other portions are derived from the accidental or careless exposure of the sesqui-carbonate of ammonia, whereby an equivalent of mono-carbonate is lost. It has been usual to reserve the salt thus obtained for forming acetate, nitrate, or other ammoniacal salts; but it is rarely used medicinally on its own merits. If it were sufficiently abundant or

could be prepared cheaply by a direct process, it would form the best yeast powder that can be offered, since it contains a larger portion of carbonic acid than any of the alkaline bicarbonates except that of lithia, which is, of course, unsuited to this use. Bicarbonate of ammonia in its purest state is a white salt, isomorphous with bicarbonate of potassa, and possesses the same crystalline form; its composition is expressed by the formula $NH_4O_2CO_2HO$; its taste is saline, with a slight ammoniacal impression, and is slowly volatile when exposed, and gradually evaporates with a slight odour of ammonia; it is soluble in eight parts of water at 60° F., and its aqueous solution exhibits an alkaline reaction with syrup of violets; it is decomposed by the heat of boiling water, giving off carbonic acid; it is nearly insoluble in strong alcohol, but soluble in 60 parts of dilute alcohol; it is readily prepared on the small scale, by dissolving out the mono-carbonate from the powdered sublimed sesqui-carbonate (which consists of one equivalent of each salt) by means of alcohol of 85 per cent, in which the bicarbonate is almost insoluble. When a saturated solution of sesqui-carbonate of ammonia in water is saturated with CO_2, a quantity of the bicarbonate separates in crystals, owing to its less solubility.

Sweet Quinine.—W. Procter, jun.—It appears that, under this name, there has been thrown into commerce, by M. F. Stearns (U.S.), an article which, according to a statement made in the manufacturer's circular, appeared to be quinine associated with liquorice sugar. The author of this paper very properly states that the article in question, having been submitted by him to chemical tests, does not contain any quinine at all, but mainly cinchonine, precipitated from the sulphate, dried and triturated with an impure glycyrrhizin prepared from liquorice root. The tastelessness of "sweet quinine" is due to the very difficult solubility of cinchonine, which requires nearly 4000 parts of cold water; with acid or alcoholic fluids, which salify and dissolve it, its bitterness becomes apparent.

The remainder of the papers of this excellent periodical are not suited for abstraction in our pages, for the reason already given.

Bayerisches Industrie und Gewerbeblatt, June, 1869.

This number contains, besides a large collection of official communications, among which is a well-digested and arranged law for limited liability companies, the following original papers:—

Utilisation of the Waste Products of Soda and Bleaching Powder Manufacture.—M. Züngerle.—The contents of this paper are, in some form or other, known to our readers, as this subject has been fully treated of in our columns. This paper does not teach us anything new, and therefore we quote nothing more from it than this—that, in Germany, the manufacture of sulphur from soda waste, and of peroxide of manganese containing 60 per cent, is carried out largely, and with success.

Use of the Miesbach Coal as Fuel at the Salt-work of Hall, in the Tyrol.—M. Hailer.—This paper is chiefly of local importance but it may be noticed that the coal here alluded to, while containing 18·6 per cent of ash, and being chiefly small coal, containing, on an average, 52 per cent of carbon, is yet successfully applied to heat the salt-pans, at almost nominal cost, since the furnace is so arranged as to get the most heat from the fuel.

Jet-Black China Varnish.—M. Marx.—Under the above name is sold a varnish for boots and shoes, which, according to the author's analytical researches, chiefly consists of an alcoholic solution of shellac. According to the author, an excellent imitation of the original may be made by dissolving 10 grms. of shellac, and 5 grms. of turpentine, in 40 grms. of strong methylated spirits, in which fluid should be previously dissolved 1 grm. of extract of logwood, with some neutral chromate of potassa and sulphate of indigo. The varnish is to be kept in well-stoppered bottles.

Parisian Copying Ink.—M. Marx.—To make this, take 30 grms. of extract of logwood, and 7·5 grms. of crystallised carbonate of soda; boil this with 240 grms. of water, and add, while vigorously stirring, 30 grms. of glycerine. When the fluid has become cold, dissolve in it 1 grm of neutral chromate of potassa, and add, lastly, 7·5 grms. of gum arabic, previously made into a thick mucilage with water. The paper upon which it is desired to transfer a copy need not be moistened if this ink is used.

Mixture for Producing "Japanese Lightning."—M. Marx.—Anhydrous saltpetre (nitrate of potassa), 33·3 parts; charcoal from lime-tree wood, 58·3; flowers of sulphur, 8·4. As to the name of Japanese lightning, it means the same as the Japanese matches Prof. A. W. Hofmann spoke about a couple of years ago, at a meeting of the Chemical Society.

Zeitschrift für Chemie, von Beilstein, No. 13, 1869.

This number contains only one original paper, the great bulk being abstracts from various periodicals written and published in English, French, Italian, and German languages. The original paper alluded to is on—

Hæmatoxyline and Hæmateine.—Dr. Tabensky.—The author states that, since MM. Erdmann and Hesse had discovered that hæmatoxyline reduces solutions of silver and becomes coloured red by the action of direct sunlight, he was induced by Prof. von Babo to make some experiments in order to discover whether the alcoholic extract of logwood might not be very serviceable in photography. For this purpose the author prepared hæmatoxyline in pure state according to Erdmann's method, taking care to re-crystallise the substance repeatedly from an alcoholic solution. Next, two glass plates, properly prepared, were exposed, in a photographic apparatus, to light, and afterwards one of these plates was treated, as usual, with pyrogallic acid, the other with a solution of hæmatoxyline. The success of the latter operation left nothing to be desired, and the further experiments of the author leave no doubt whatever that hæmatoxyline may be advantageously applied in photography. The quantities best suited for this solution are as follows:—Hæmatoxyline, 0·5 grm.; distilled water, 80 grms.; 22 grms. of acetic acid of 33° strength; and a small quantity of glycerin. The method of preparation of hæmateine has been altered and improved by the author of this paper in the following manner:—By means of an aspirator, air is drawn through a bottle filled, for one-third of its capacity, with liquid ammonia; and the current of air thus charged with ammonia is made to pass slowly over and through hæmatoxyline suspended in water; but care is to be taken that the glass tube through which the air charged with ammonia strikes should only just dip very slightly under the surface of the water; by this means, excess of ammonia is excluded, and the formation of amorphous brown substances is prevented. By this method, from 10 to 12 grms. of hæmatoxyline are changed, within three hours, into hæmateine, yielding a magnificently purple-coloured solution, which is precipitated by bisulphite of ammonia when cold; but, on heating, this precipitate becomes re-dissolved. Hæmatoxyline is, according to M. Hesse, composed of $C_{28}H_{14}O_{12}+2HO$; hæmateine is $C_{28}H_9O_9+HO$. The former substance is a very weak acid, rather difficultly soluble in water, but very readily in an aqueous solution of borax; it is best and easiest prepared from the extract of logwood met with in commerce.

On Dichloraldehyde.—M. E. Paterno.—This paper, being taken from an Italian periodical which does not come to England, is therefore abstracted. The author states that he treated dichloraldehyde with chloride of phosphorus, with the view thus to obtain the chloride $CHCl_2—CHCl_2$; but this was not the result of the reaction between the two substances just named; a product was obtained which boils at 250°, and which, on being submitted to elementary organic analysis, gave results leading to the formula $C_4H_4Cl_6O$. The constitution of this substance is apparently that of an ethyliden-oxychloride, the composition of which is to be indicated by either of the two following formulæ:—

$$CHCl_2—CH_2—O—CCl_2—CHCl_2,$$

or by—

$$CHCl_2—CHCl—O—CHCl—CHCl_2.$$

The substance, $C_4H_4Cl_6O$, is a somewhat coloured oil, heavier than water, soluble in alcohol and ether, boiling at 250°, and giving off very irritating acid fumes; on being mixed with an alcoholic solution of caustic potassa, a very violent reaction ensues, and, on addition of water, an aromatic-smelling oil is separated, which boils at 196°, and has the formula $C_4H_4Cl_4O$. This substance combines readily with bromine, forming a solid crystalline substance fusing at 60°, and having for its formula $C_4H_4Cl_4Br_4O$. Dichloraldehyde is not readily oxidised; when its vapour, mixed with air, is passed through a tube containing spongy platinum, no perceptible change ensues; mixed with its own bulk of red fuming nitric acid, a very energetic reaction sets in; when this has somewhat subsided, and the excess of nitric has been expelled by evaporation, and the residue is submitted to distillation and rectification, dichloracetic acid is obtained, which boils at about 195°, and yields, when distilled with a mixture of concentrated sulphuric acid and alcohol of 90 per cent, pure dichloracetic ether boiling at 155°.

Crystallised Digitaline.—M. Nativelle.—This alkaloid is obtained in crystalline state in the following manner:—100 parts, by weight, of coarsely-powdered *herba digitalis* is mixed with a solution of 25 parts of acetate of lead in 100 parts of water, left standing for twelve hours, and then exhausted with water; the residue is treated with alcohol of 50° until the solution thereof is free from any taste. The solution thus obtained is treated with a solution (aqueous) of four parts of acetate of lead, and filtered. To this filtrate is next added a solution of two parts of phosphate of soda, again filtered, and the alcohol removed by distillation on a water-bath. It will be observed that, in the residue of the distillation, there are suspended, in the aqueous fluid, small crystals, surrounded by a yellowish-coloured, very bitter-tasted substance. The residue of the distillation is concentrated, by evaporation on a water-bath to about ten parts, next filtered, washed with cold water, the precipitate dried by pressing it between folds of filtering paper, dissolved in about twice its weight of alcohol of 60 per cent, and put by in a cool place. While thus standing, two different sets of crystals are separated—first, those of an inactive substance; next, after some days, yellowish-coloured crystals of digitaline. After these have been fully formed, the mother liquor is run off, and the crystalline mass is taken up with alcohol of 80 per cent, while, at the same time, some animal charcoal is added. The solution, having been filtered and left to evaporate, is treated with pure chloroform, and strongly shaken up with it; the digitaline only is dissolved. On distilling off the chloroform, a somewhat coloured digitaline is obtained, which is further purified by repeated treatment with alcohol and animal charcoal. The crystalline digitaline is a neutral, non-nitrogenous, inodourous substance, of very bitter taste, readily soluble in chloroform, while one part of this digitaline requires twelve parts of alcohol of 90 per cent for its solution at the ordinary temperature; it is slightly more soluble in boiling alcohol, but far less soluble in absolute alcohol and in pure ether, and, practically, entirely insoluble in water at any temperature. Sulphuric acid dissolves this substance, yielding a greenish-coloured solution, which, on contact of vapours of bromine, becomes *groseille* red coloured; but addition of water restores the original green colour. Hydrochloric acid, also, dissolves digitaline, exhibiting, likewise, a green solution, from which water precipitates a resinous matter. The result of the elementary organic analysis of digitaline led to the formula $C_{72}H_{40}O_{15}$. The other crystalline substance above mentioned is insoluble in chloroform, soluble in alcohol;

crystallises in colourless needle-shaped crystals which are devoid of taste, neutral to test-papers, free from nitrogen, less soluble in alcohol than digitaline, and practically insoluble in water and ether. With sulphuric acid, this substance yields a *groscille* red coloured solution, which turns yellow on addition of water; nitric acid dissolves this substance to a colourless fluid, while hydrochloric acid is hardly capable of dissolving it at all. There is no elementary organic analysis as yet made of this substance, but it has been ascertained to be free from nitrogen.

Polytechnisches Journal von Dingler, first number for July, 1869.

This number contains the following original papers:—

On Stoves suitably constructed to Burn Coal as Fuel for Heating Rooms in Dwelling-Houses.—M. W. Hohbach.—The author describes, at length, an excellently arranged stove, by the use of which economy of fuel and proper supply of fresh air to the room are secured. A stove of medium size is so arranged that with from 15 to 20 lbs. of coal, a room of 12,000 cubic feet capacity is kept heated to 16° Réaumur (=20° C., and 68° F.) for from eight to twelve hours. The construction of this stove could not be well understood without the reproduction of the engravings accompanying the original.

Chemical Composition of Native Chrome Iron Ore.—M. Clouet.—After referring to the kinds of rock wherein this ore occurs, the author states that all varieties of chrome iron ore which have been hitherto analysed exhibit a constant and definite chemical composition. As instances, he quotes the following analysis:—$FeOCr_2O_3$, Russian ore, as, also, Smyrna and Norway (Drontheim); $2FeO,Cr_2O_3$, Ile à Vaches, St. Domingo; $2FeO,3Cr_2O_3$, Russia (another district); $4FeO,5Cr_2O_3$, the Banat (Alt-Orsowa); $8FeO,5Cr_2O_3$, India; $6FeO,5Cr_2O_3$, California; $3FeO,2Cr_2O_3$, Australia. A sample of pure crystalline octahedrical ore from the Ile à Vaches was found by the author to consist, in 100 parts, of—Oxide of chromium, 51·53; protoxide of iron, 48·46. Formula, $2FeO,Cr_2O_3$. The author enters, at great length, into particulars about the analysis of chrome iron ores; but, since any good treatise on analytical chemistry may be consulted on this subject, we do not notice this part of his paper here any further.

Manufacture of Hyposulphite of Soda from Soda Waste.—M. Schaftner.—This paper is entirely a lengthy description of a manufacturing process on the large scale. The main facts are—that, to the soda waste, sulphate of soda is added; and, after this mixture has been exposed for some time to the influence of the air, it is lixiviated with water. Sulphur is obtained as a by-product.

Contribution to our Knowledge of the Relation of Carbon to Oxygen.—Dr. Richters.—This paper is far too lengthy for any useful abstraction. The chief point thoroughly elucidated by the author is the oxidation of coal, charcoal, and coke at comparatively low temperatures.

On Balata.—M. Sperlich.—Balata is the inspissated milk-juice of the *Sapota muelleri*, a tree met with in large numbers in the three Guianas. Balata appears to hold a middle place between caoutchouc and gutta-percha. The author obtained the raw material, and, after having first treated it with boiling acidulated water, next with absolute alcohol, he dried the substance, and next dissolved it, with the aid of gentle heat, in sulphide of carbon. After removing that fluid by distillation, the balata was repeatedly boiled with a mixture of ether and alcohol, well dried and submitted to elementary analysis, yielding, in 100 parts, 88·49 of carbon and 11·37 of hydrogen, and, therefore, pretty nearly the composition of purified gutta-percha, which gives 87·91 of carbon, and 11·94 of hydrogen.

Use of Maize (Indian Corn) for Distillation of Spirits in Hungary.—Dr. Schultze.—This paper is chiefly written for distillers. The use of maize is a good idea. Curiously enough, experience appears to have taught that this grain requires, after having been ground to meal, to be steeped for about twenty-four hours in water containing sulphurous acid gas in solution. The next operation is the boiling of the meal, after which it is, when sufficiently cool, mixed with green barley malt. The quantity of spirits obtained from this material is large, and the quality good.

Alloys for Bells.—M. Lichtenberger.—It appears that for some time there have been met, in the trade in Germany, clock-bells of excellent and loud silvery tone; the author of this paper was induced, therefore, to analyse—(1) the metal the bell of a large-sized house-clock is made of, (2) a smaller bell, (3) bells for horse-harness, and (4) an ordinary small yellow-metal bell; the results are as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.
Copper	83·22	83·09	84·50	79·90
Tin	16·76	16·80	15·42	20·03

The Nos. 1 to 3 are from the same manufactory.

New Method of Bleaching Feathers.—M. Duflot.—This process is an entirely newly-discovered one, whereby the feathers of ostriches and other birds may be bleached, even if these feathers are naturally black or dark grey-coloured. The feathers are placed for from three to four hours in a tepid dilute solution of bichromate of potassa, to which, cautiously, some nitric acid has been added. After this lapse of time, the feathers will be found to have assumed a greenish hue, owing to the oxide of chromium precipitated on the substance; in order to remove this, the feathers are placed in a dilute solution of sulphurous acid in water, whereby the feathers become perfectly white and bleached. Care is to be taken that the solution of bichromate be not made too strong, and, especially, that not too much nitric acid be used, which would cause an irremovable yellow colour.

Annales du Génie Civil, July, 1869.

This number does not contain any papers or communications relative to chemistry, but we learn from it the—

Abolition of Patents for Inventions in the Netherlands.—A law has been made cancelling the old patent law of 1817; and, though all existing patents remain in force, no new ones are to be any more granted from and after the 1st day of August, 1869.

Moniteur Scientifique, August 1, 1869.

This number contains the following original papers:—

On the Cooling Down of the Sun.—M. Lecoq.—This is a very lengthy, and rather speculative treatise on a subject partly belonging to astronomy and partly to physical geography. The author deserves great credit for the lucid manner of his exposition; but we cannot enter into details on this matter, however interesting it may be.

Quantity of Heat Developed in Interrupted Electric and Galvanic Currents.—MM. Jamin and Roger.—A purely mathematico-physical paper.

On Toluol and the Alkaloid it Yields.—M. Rosenstiehl.—The greater part of the contents of this paper have been previously published, and have been quoted by us from another periodical: but we translate the last few lines of this publication for the practical value therein contained:—"Toluol is a unique and peculiar hydrocarbon, which, on being treated with nitric acid, yields, simultaneously, two nitro-derivatives (the manufacturer who desires to obtain alkaloids, in order to prepare therewith colouring matters, should take care to produce as little crystallised nitrotoluol as possible). The isomerism manifested after the action of nitric acid is maintained in its coloured derivatives. Although the two toluidines differ, as regards their chemical properties, they yield colouring matters the physical properties of which are identical. The fact of the existence of isomerism of the artificial colouring substances explains the large number of varied blue and violet matters obtained from fuchsine; this may lead to the discovery of a large number of isomers of one and the same colour; and this subject I intend to take up, experimentally, within a short time.

Fusible Alloys.—M. Stewart mixes 7·5 parts of bismuth, 4 of lead, 1·5 of tin, and 2 of cadmium, and thus produces an alloy fusing at 66°. We quote hereunder the composition of divers fusible alloys, respectively, so made that the quantity of bismuth of each is the same:—

	Newton's Alloy.	D'Arcet's Alloy.	Pelouze's Alloy.	Wood's Alloy.
Bismuth	600	600	600	600
Lead	375	300	360	320
Tin	225	300	240	160
Cadmium	—	—	—	120
	1200	1200	1200	1200

All these alloys fuse below 100°.

Under the title of—

What is Going on in Germany, we find in this periodical an excellent account briefly summarising the history, progress, and present state of the Prussian universities. The most ancient of these is that of Griefswald, founded in the year 1456; the youngest is Bonn, founded in 1818. Leaving the Austrian dominions altogether out of the question, Germany, that is to say, the North German Confederation and the Southern Independent German States, contain together 19 universities, with 773 ordinary, and 340 extraordinary professors, and 342 repetitors, and, collectively, frequented by an average of 14,383 students. Some of these institutions have large revenues; foremost among these is Tübingen, Wurtemberg, with an annual revenue of 100,000 florins (about £10,000). All of these universities are under government control, and the expenses are met by regular grants made with great liberality. The population of this portion of Germany amounts to about 36,000,000, and the area, in German geographical square miles, amounts to about 10,000.

NOTES AND QUERIES.

Yeast.—The essential cause of the difference of beer-yeast and the so-called German yeast, is due—1st, to the materials submitted to fermentation; 2nd, to the mode of conducting that process. The so-called German yeast is chiefly made at Schiedam, and owes its origin and qualities to the large quantity of raw (that is to say, unmalted) grain, chiefly rye, used for making Hollands. More correctly speaking, the starch of the grain, after having been converted into sugar by the aid of a comparatively small quantity of barley-malt, is suffered to undergo alcoholic fermentation. This fermentation proceeds far more slowly than the fermentation of the wort of malt intended for beer; and it is the slowness of this process, the use of raw grain, and the peculiar mode of setting up the fermentation, which constitute the essential difference of the yeast. After it leaves the distilleries, the yeast is carefully washed with very cold and pure water, and often, though not always, mixed with some very finely-ground starch; and, next, strongly pressed into stout canvas bags, and sent off to Paris, Berlin, Vienna, and elsewhere. If beer-yeast were washed, it would, perhaps, keep a longer time, but never so long as the yeast just alluded to, owing to the fact that the formation of beer-yeast takes place more tumultuously. German yeast has been made perfectly dry over sulphuric acid *in vacuo*, and in that state it may be kept, in well-closed bottles or tin canisters, in a dry and cool place, for any length of time, and has been sent, in good condition, even to Batavia and Calcutta.

THE CHEMICAL NEWS.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Exeter Meeting, August 18, 1869.

INAUGURAL ADDRESS OF THE PRESIDENT,

George Gabriel Stokes, M.A., Sec. R.S., D.C.L., Oxon.; LL.D., Dublin; Fellow of Pembroke College; and Lucasian Professor of Mathematics in the University of Cambridge.

(Concluded from p. 89).

Researches on Gun-Cotton.

As I have mentioned an application to the Government on the part of the Association which was not successful, it is but right to say that such is not generally the result: I will refer to one instance. At the Cambridge meeting of the Association, in 1862, a committee, consisting of representatives of the Mechanical and Chemical Sections, was appointed for the purpose of investigating the application of gun-cotton to warlike purposes. At the Newcastle meeting, in the following year, this committee presented their report. It was felt that a complete study of the subject demanded appliances which could be obtained only from our military resources; and at the Newcastle meeting a resolution was passed recommending the appointment of a royal commission. This recommendation was adopted, and, in 1864, a commission was appointed, which was requested to report on the application of gun-cotton to civil as well as to naval and military purposes. The committee gave in their report last year, and that report, together with a more recent return relative to the application of gun-cotton to mining and quarrying operations, has just been printed for the House of Commons.

A substance of such comparatively recent introduction cannot be fairly compared with an explosive in the use of which we have the experience of centuries. Yet, even with our present experience, there are some purposes for which gun-cotton can advantageously replace gunpowder, while its manufacture and storage can be effected with comparative safety, since it is in a wet state during the process of manufacture, and is not at all injured by being kept permanently in water, but merely requires to be dried for use. Even should it be required to store it in the dry state, it is doubtful whether, with the precautions indicated by the chemical investigations of Mr. Abel, any greater risk is incurred than in the case of gunpowder. In the blasting of hard rocks it is found to be highly efficient; while the remarkable results recently obtained by Mr. Abel leave no doubt of its value for explosions such as are frequently required in warfare. General Hay speaks highly of the promise of its value for small arms; but many more experiments are required, especially as a change in the arm and mode of ignition require a change in the construction of the cartridge. In heavy ordnance, the due control of the rapidity of combustion of the substance is a matter of greater difficulty; and, though considerable progress has been made, much remains to be done before the three conditions of safety to the gun, high velocity of projection, and uniformity of result, are satisfactorily combined.

Deep Sea Soundings.

By the kindness of Dr. Carpenter, I am enabled to mention to you the latest results obtained in an expedition which could not have been undertaken without the aid of Government—an aid which was freely given. Last year, Dr. Carpenter and Professor Wyville Thomson represented to the President and Council of the Royal Society the great importance to zoology and palæontology of obtaining soundings from great depths in the ocean, and suggested to them to use their influence with the Admiralty to induce them to place a gun-boat, or other suitable vessel, at the disposal of those gentlemen, and any other naturalists who might be willing to accompany them, for the purpose of carrying on a systematic course of deep-sea dredging for a month or six weeks. This application was forwarded to the Admiralty with the warm support of the President and Council, and was readily acceded to. The operations were a good deal impeded by rough weather, but, nevertheless, important results were obtained. Dredging was successfully accomplished at a depth of 650 fathoms; and the existence was established of a varied and abundant submarine fauna, at depths which had generally been supposed to be either azoic or occupied by animals of a very low type; and the character of the fauna and of the mud brought up was such as to point to a chalk formation actually going on.

It seemed desirable to carry the soundings to still greater depths, and to examine more fully the changes of temperature which had been met with in the descent. Another application was accordingly made to the Admiralty, in the present year, and was no less readily acceded to than the former; and a larger vessel than that used last year is now on her cruise. I am informed by Dr. Carpenter that dredging has been successfully carried down to more than 2400 fathoms (nearly the height of Mont Blanc), and that animal life has been found, even at that depth, in considerable *variety*, though its *amount* and *kind* are obviously influenced by the reduction of temperature to Arctic coldness. A very careful series of temperature soundings has been taken, showing, on the same spot, a continuous descent of temperature with the depth, at first more rapid, afterward pretty uniform. Thermometers protected from pressure by a plan described by Dr. Miller were found to maintain their character at the great depths reached, the difference between them and the best ordinary thermometers used in the same sounding being exactly conformable to the pressure corresponding with each depth, as determined by the experiments previously made in smaller depths. All the observations hitherto made go to confirm the idea of a general interchange of polar and equatorial water, the former occupying the lowest depths, the latter forming a superficial stratum of 700 or 800 fathoms. The analyses of the water brought up indicate a large proportion of carbonic acid in the gases of the deep waters, and a general diffusion of organic matter.

The Faraday Memorial.

I must turn, for a few moments, to another application recently made to Government, which has not been successful. The application I have in view was made, not by the British Association or other scientific societies in their corporate capacity, but by a body composed of the Presidents of the British Association, and of the Royal and other leading scientific societies; and its object was, not the promotion of science directly, but the recognition of pre-eminent scientific merit. In the history of science, few names, indeed, hold so prominent a place as that of Faraday. The perfect novelty of principle, and recondite nature of many of his great discoveries, are such as to bear the impress of genius of the highest order, and to form an epoch in the advance of science; and, while his scientific labours excited the admiration of men of science throughout the world, his singularly genial disposition, and modest, unassuming character, won for him the love of those who had the happiness of numbering him among their personal friends. At a meeting of the presidents of

the scientific societies to which I have alluded, it was resolved to erect a marble statue in memory of Faraday. He was a man of whom England may well be proud, and it was thought that it would be a graceful recognition of his merits if the monument were erected at the public expense. The present Chancellor of the Exchequer, however, did not think it right that the recognition of scientific merit, however eminent, should fall on the taxation of the country, though, even in a pecuniary point of view, the country has received so much benefit from the labours of scientific men. The carrying out of the resolution being thus left to private exertion, a public meeting, presided over by H.R.H. the Prince of Wales, was held in the Royal Institution, an establishment which has the honour of being identified with Faraday's scientific career. At this meeting a committee was formed to carry out the object, and a subscription list commenced. By permission of the secretaries of this association, an office has been opened in the Reception Room, where those members of the association who may be desirous of taking part in the movement will have every facility afforded them.

Recent Discoveries in Chemistry.

In chemistry, I do not believe that any great step has been made within the last year; but perhaps there is no science in which an earnest worker is so sure of being rewarded by making some substantial acquisition to our knowledge, though it may not be of the nature of one of those grand discoveries which from time to time stamp their impress on different branches of science. I may be permitted to refer to one or two discoveries which are exceedingly curious, and some of which may prove of considerable practical importance.

Turacine.

The turaco or plantain-eater of the Cape of Good Hope is celebrated for its beautiful plumage. A portion of the wings is of a fine red colour. This red colouring-matter has been investigated by Professor Church, who finds it to contain nearly six per cent of copper, which cannot be distinguished by the ordinary tests, nor removed from the colouring-matter without destroying it. The colouring-matter is, in fact, a natural organic compound, of which copper is one of the essential constituents. Traces of this metal had previously been found in animals—for example, in oysters, to the cost of those who partook of them. But, in these cases, the presence of the copper was merely accidental; thus oysters that lived near the mouths of streams which came down from copper mines assimilated a portion of the copper salt, without apparently its doing them either good or harm. But, in the turaco, the existence of the red colouring-matter which belongs to their normal plumage is dependent upon copper, which, obtained in minute quantities with the food, is stored up in this strange manner in the system of the animal. Thus, in the very same feather, partly red and partly black, copper was found in abundance in the red parts, but none, or only the merest trace, in the black.

This example warns us against taking too utilitarian a view of the plan of creation. Here we have a chemical substance elaborated which is perfectly unique in its nature, and contains a metal the salts of which are ordinarily regarded as poisonous to animals; and the sole purpose to which, so far as we know, it is subservient in the animal economy is one of pure decoration. Thus, a pair of fine birds which were kept in captivity lost their fine red colour in the course of a few days, in consequence of washing in the water which was left them to drink, the red colouring-matter, which is soluble in water, being thus washed out; but, except as to the loss of their beauty, it does not appear that the birds were the worse for it.

Artificial Alizarine.

A large part of the calicos which are produced in this country in such enormous quantities are sent out into the market in the printed form. Although other substances are employed, the place which madder occupies among dye-stuffs with the calico-printer is compared by Mr. Schunck to that which iron occupies among metals with the engineer. It appears, from the public returns, that upwards of 10,000 tons of madder are imported annually into the United Kingdom. The colours which madder yields to mordanted cloth are due to two substances, alizarine and purpurine, derived from the root. Of these, alizarine is deemed the most important, as producing faster colours and yielding finer violets. In studying the transformations of alizarine under the action of chemical reagents, MM. Græbe and Liebermann were led to connect it with anthracene, one of the coal-tar series of bodies, and to devise a mode of forming it artificially. The discovery is still too recent to allow us to judge of the cost with which it can be obtained by artificial formation, which must decide the question of its commercial employment. But, assuming it to be thus obtained at a sufficiently cheap rate, what a remarkable example does the discovery afford of the way in which the philosopher, quietly working in his laboratory, may obtain results which revolutionise the industry of nations! To the calico-printer, indeed, it may make no very important difference, whether he continues to use madder, or replaces it by the artificial substance; but what a sweeping change is made in the madder-growing interest! What hundreds of acres, hitherto employed in madder cultivation, are set free for the production of human food, or of some other substance useful to man! Such changes can hardly be made without temporary inconvenience to those who are interested in the branches of industry affected; but we must not, on that account, attempt to stay the progress of discovery, which is conducive to the general weal.

Apomorphia.

Another example of the way in which practical applications unexpectedly turn up when science is pursued for its own sake, is afforded by a result recently obtained by Dr. Matthiessen, in his investigation of the constitution of the opium bases. He found that, by the action of hydrochloric acid on morphia, a new base was produced, which, as to composition, differed from the former merely by the removal of one equivalent of water. But the physiological action of the new base was utterly different from that of the original one. While morphia is a powerful narcotic, the use of which is apt to be followed by subsequent depression, the new base was found to be free from narcotic properties, but to be a powerful emetic, the action of which was unattended by injurious after-effects. It seems likely to become a valuable remedial agent.

In relation to mechanism, this year is remarkable as being the centenary of the great invention of our countryman, James Watt. It was in the year 1769 that he took out his patent involving the invention of separate condensation, which is justly regarded as forming the birth of the steam-engine. Little could even his inventive mind have foreseen the magnitude of the gift he was conferring on mankind in general, and on his own country more particularly. In these days of steamers, power-looms, and railways, it requires no small effort to place ourselves, in imagination, in the condition we should be in without the steam-engine. It needs no formal celebration to remind Britons of what they owe to Watt. Of him, truly it may be said "*si monumentum requiras, circumspice.*"

The Relations between Physical and Biological Sciences.

With reference to those branches of science in which we are more or less concerned with the phenomena of life, my own studies give me no right to address you. I regret this the less because my predecessor, and my probable successor in the presidential chair are both of well-known eminence in this department. But I hope I may be permitted, as a physicist, and viewing the question from the physical side, to express to you my views as to the relation which the physical bear to the biological sciences.

No other physical science has been brought to such

perfection as mechanics; and in mechanics we have long been familiar with the idea of the perfect generality of its laws, of their applicability to bodies organic as well as inorganic, living as well as dead. Thus, in a railway collision, when a train is suddenly arrested, the passengers are thrown forward, by virtue of the inertia of their bodies, precisely according to the laws which regulate the motion of dead matter. So trite has the idea become, that the reference to it may seem childish; but, from mechanics, let us pass on to chemistry, and the case will be found by no means so clear. When chemists ceased to be content with the mere ultimate analysis of organic substances, and set themselves to study their proximate constituents, a great number of definite chemical compounds were obtained which could not be formed artificially. I do not know what may have been the usual opinion at that time among chemists as to their mode of formation. Probably it may have been imagined that chemical affinities were indeed concerned in their formation, but controlled and modified by an assumed vital force. But, as the science progressed, many of these organic substances were formed artificially, in some cases from other and perfectly distinct organic substances, in other cases actually from their elements. This statement must, indeed, be accepted with one qualification. It was stated several years ago, by M. Pasteur, and I believe the statement still remains true, that no substance, the solution of which possesses the property of rotating the plane of polarisation of polarised light, had been formed artificially from substances not possessing that property. Now several of the natural substances which are deemed to have been produced artificially are active, in the sense of rotating the plane of polarisation; and, therefore, in these cases, the inactive artificial substances cannot be absolutely identical with the natural ones. But the inactivity of the artificial substance is readily explained on the supposition that the artificial substance bears to the natural the same relation as racemic acid bears to tartaric—that it is, so to speak, a mixture of the natural substance with its image in a mirror. And when we remember by what a peculiar and troublesome process M. Pasteur succeeded in separating racemic acid into the right-handed and left-handed tartaric acids, it will be at once understood how easily the fact, if it be a fact, of the existence in, the natural substance, of a mixture of two substances, one right-handed and the other left-handed, but otherwise identical, may have escaped detection. This is a curious point, to the clearing up of which it is desirable that chemists should direct their attention. Waiving, then, the difference of activity or inactivity, which, as we have seen, admits of a simple physical explanation, though the correctness of that explanation remains to be investigated, we may say that, at the present time, a considerable number of what used to be regarded as essentially natural organic substances have been formed in the laboratory. That being the case, it seems most reasonable to suppose that, in the plant or animal from which those organic substances were obtained, they were formed by the play of ordinary chemical affinity, not necessarily nor probably by the same series of reactions by which they were formed in the laboratory, where a high temperature is commonly employed, but still by chemical reactions of some kind, under the agency, in many cases of light, an agency sometimes employed by the chemist in his laboratory. And, since the boundary line between the natural substances which have and those which have not been formed artificially, is one which, so far as we know, simply depends upon the amount of our knowledge, and is continually changing as new processes are discovered, we are led to extend the same reasoning to the various chemical substances of which organic structures are made up.

But do the laws of chemical affinity, to which, as I have endeavoured to infer, living beings, whether vegetable or animal, are in absolute subjection, together with those of capillary attraction, of diffusion, and so forth, account for the formation of an organic structure, as distinguished from the elaboration of the chemical substances of which it is composed? No more, it seems to me, than the laws of motion account for the union of oxygen and hydrogen to form water, though the ponderable matter so uniting is subject to the laws of motion during the act of union just as well as before and after. In the various processes of crystallisation, of precipitation, and so forth, which we witness in dead matter, I cannot see the faintest shadow of an approach to the formation of an organic structure, still less to the wonderful series of changes which are concerned in the growth and perpetuation of even the lowliest plant. Admitting, to the full, as highly probable, though not completely demonstrated, the applicability to living beings of the laws which have been ascertained with reference to dead matter, I feel constrained, at the same time, to admit the existence of a mysterious *something* lying beyond—a something, *sui generis*, which I regard, not as balancing and suspending the ordinary physical laws, but as working with them and through them to the attainment of a designed end.

What this *something*, which we call life, may be, is a profound mystery. We know not how many links in the chain of secondary causation may yet remain behind; we know not how few. It would be presumptuous, indeed, to assume, in any case, that we had already reached the last link, and to charge with irreverence a fellow worker who attempted to push his investigations yet one step further back. On the other hand, if a thick darkness enshrouds all beyond, we have no right to assume it to be impossible that we should have reached even the last link of the chain; a stage where further progress is unattainable, and we can only refer the highest law at which we stopped to the fiat of an Almighty Power. To assume the contrary as a matter of necessity, is, practically, to remove the First Cause of all to an infinite distance from us. The boundary, however, between what is clearly known and what is veiled in impenetrable darkness, is not ordinarily thus sharply defined. Between the two there lies a misty region, in which loom the ill-discerned forms of links of the chain which are yet beyond us. But the general principle is not effected thereby. Let us fearlessly trace the dependence of link on link as far as it may be given us to trace it; but let us take heed that, in thus studying second causes, we forget not the First Cause, nor shut our eyes to the wonderful proofs of design which, in the study of organised beings especially, meet us at every turn.

Truth we know must be self-consistent, nor can one truth contradict another, even though the two may have been arrived at by totally different processes—in the one case, suppose, obtained by sound scientific investigation, in the other case taken on trust from duly authenticated witnesses. Misinterpretations, of course, there may be on the one side or on the other, causing apparent contradictions. Every mathematician knows that in his private work he will occasionally, by two different trains of reasoning, arrive at discordant conclusions. He is at once aware that there must be a slip somewhere, and sets himself to detect and correct it. When conclusions rest on probable evidence, the reconciling of apparent contradictions is not so simple and certain. It requires the exercise of a calm, unbiassed judgment, capable of looking at both sides of the question; and oftentimes we have long to suspend our decision, and seek for further evidence. None need fear the effect of scientific enquiry carried on in an honest, truth-loving, humble spirit, which makes us no less ready frankly to avow our ignorance of what we cannot explain, than to accept conclusions based on sound evidence. The slow but sure path of induction is open to us. Let us frame hypotheses if we will: most useful are they when kept in their proper place, as stimulating inquiry. Let us seek to confront them with observation and experiment, thereby confirming or upsetting them, as the result may prove; but let us beware of placing them prematurely in the rank of ascertained truths, and building further conclusions on them, as if they were.

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When, from the phenomena of life, we pass on to those of mind, we enter a region still more profoundly mysterious. We can readily imagine that we *may* here be dealing with phenomena altogether transcending those of mere life, in some such way as those of life transcend, as I have endeavoured to infer, those of chemistry and molecular attractions, or as the laws of chemical affinity, in their turn, transcend those of mere mechanics. Science can be expected to do but little to aid us here, since the instrument of research is itself the object of investigation. It can but enlighten us as to the depth of our ignorance, and lead us to look to a higher aid for that which most nearly concerns our well-being.

PRELIMINARY REPORT OF THE COMMITTEE APPOINTED FOR THE

DETERMINATION OF THE GASES EXISTING IN SOLUTION IN WELL WATERS.*

By DR. E. FRANKLAND, F.R.S., and HERBERT McLEOD, F.C.S.

In consequence of the investigation being far from complete, this report must be considered as merely a preliminary one; a more detailed account of the results obtained and the inferences to be drawn from them must be postponed till a future occasion.

The apparatus employed in these and other experiments was described at the last meeting of the Chemical Society, and will shortly be published in the *Journal*.†

In collecting the waters, it is, of course, of the greatest importance that they should be prevented from coming in contact with the air, otherwise, serious errors might be produced in the determination of the gases dissolved. In order to avoid these errors, the tap delivering the water from the pumps is connected, by means of a caoutchouc tube, with a tubulure at the bottom of a tin cylinder, about 10 inches high, and 7 in diameter. The water is turned on, and allowed to flow over the edge of the vessel; thus only the surface of the water is exposed to the action of the air, and the liquid at the lower part of the vessel is protected by the upward current and continual overflow.

The bottles used for collecting the waters hold a little more than 100 c.c., and a separate quantity is used for each experiment. Into each bottle a piece of glass tube bent in the form of a U is introduced; one end of the tube is sealed, and, in the closed limb, a bubble of air is confined by mercury, which fills the open limb and the bend. In the collection of each water, four of these bottles are lowered, by means of pieces of string, into the tin vessel while the water is flowing over its edge. After being filled, each bottle is carefully examined, and, if any bubbles of gas adhere to the sides, they must be removed. The bottles are then again lowered into the vessel, and the temperature observed. A syphon is now passed to the bottom of one of the bottles, and, after it has drawn two or three hundred cubic centimetres of water through the bottle, it is placed into the second. The first bottle is now raised, and, while its neck is still under the water, a slightly-greased stopper is put into the neck, and carefully pressed down. This force compresses the air contained in the glass tube, and, if the pressure is sufficient, it prevents the escape of gas from the water—a precaution which, in some cases, is very necessary. The syphon is then transferred from the second into the third bottle, and the second is closed and removed. When the four bottles have been filled, the stoppers are covered with ground caps. The caps are next filled with mercury, through small holes at their tops, which are afterwards closed with glass stoppers.

The gases should be removed from the waters as soon after collection as possible. In the following cases, the greatest length of time which was allowed to elapse between these operations was five days; but usually the removal of the gases was effected the day after the collection.

	I. Rain-water.	II. Water from cistern of Royal College of Chemistry, supplied by Grand Junction Company.	III. Water from well, in chalk, 367 ft. deep, at Messrs. Barclay and Perkins's Brewery, Southwark.	IV. Water from well not down to chalk, in course of construction, 143½ ft. deep, at Messrs. Barclay and Perkins's Brewery, Southwark.	V. Water from chalk well at Worthing.	VI. Water from surface well to face of the chalk, 27—30 ft. deep, at Mr. Hills's Brewery, Deal. In the town. Influenced by the tide.	VII. Water from chalk well 115 ft. deep, Waterworks, Deal, surrounded by cultivated fields. Not influenced by tide.	VIII. Water from Waterworks, Deal, drawn from main about a mile from the reservoir.
Temperature at time of collection (° C.) ..	15·5	14·8	12·1	12	(?)	11·9	14·8	17·2
Mean of	2 expts.	2 expts.	2 expts.	4 expts.	2 expts.	2 expts.	2 expts.	2 expts.
Volumes of gases in 100 volumes of water. Nitrogen ..	1·382	1·397	2·030	1·973	1·552	1·704	1·548	2·241
Oxygen ..	0·673	0·620	0·029	0·018	0·446	0·023	0·580	0·796
Carbonic anhydride	0·135	4·239	5·765	3·814	5·452	10·252	5·055	4·413
Total ..	2·190	6·256	7·824	5·805	7·450	11·979	7·183	7·450
Solubility of nitrogen in 100 volumes of distilled water (Bunsen) ..	1·468 at 15·5°	1·478 at 15°	1·549 at 12°	1·549 at 12°	—	1·549 at 12°	1·478 at 15°	1·441 at 17°

The experimental results, of which the above numbers are the means, were tolerably concordant. The greatest differences between the results of different experiments are the following:—In water No. IV., experiment 3 gave 0·140 parts more nitrogen than experiment 2; in water No. VII., the oxgyen obtained in the second experiment was 0·045 in excess of the quantity obtained in the first; in water No. III., the second experiment gave 0·760 parts more carbonic anhydride than the other. Since this last was done, the mode of collection and removal of the gases have been improved.

With so few results as have been obtained up to the present, it will be impossible to do more than point out the small quantity of oxygen in the waters from deep wells as compared with those from shallow ones, and with rain and river waters. The quantity of nitrogen is also very remarkable as being, in all the cases, except the river and rain waters, in excess of the amount absorbable by distilled water. To show this, there is introduced into the foregoing table numbers from Bunsen's gasometry, indicating the quantities of nitrogen absorbable by 100 volumes of

* Read before the British Association, Exeter meeting, Section B.

† See Chemical News, vol. xx., p. 20.

distilled water at the temperatures which are nearest to those at which the waters were collected. The reasons of this apparent anomaly will be investigated during the course of the ensuing year, and it is hoped that, by the next meeting of the Association, a much larger amount of information will have been obtained. The prosecution of the experiments has been much hindered by the necessity of perfecting the apparatus for the removal of the gases and the means of collection, so that it was not until after the commencement of July that any systematic work could be commenced.

REPORT ON THE CHEMICAL NATURE OF CAST-IRON.*

By Messrs. F. A. ABEL, F.R.S., D. FORBES, F.R.S., and A. MATTHIESSEN, F.R.S.

THE Committee have to report that, during the past year, some material progress has been made in this research. They entrusted the preparation of pure iron to Dr. Matthiessen, who carried out this part of the investigation in conjunction with M. Prus-Szczepanowski. From a series of experiments, which are detailed in the Appendix, pure iron appeared to be obtainable in considerable quantities; and we hope, if the Committee be re-appointed, that next year a great deal of valuable information will be obtained on the chemical nature and physical properties of pure iron and its alloys. The iron obtained by the process described in the Appendix is almost absolutely pure, containing only a minute trace of sulphur. According to an analysis made by Professor Abel, the iron contained, in 100 parts, only 0·00025 parts of sulphur. In another analysis, the amount of sulphur found by M. Prus-Szczepanowski amounted to 0·0007 per cent. Phosphorus and silicon were carefully tested for by both analysts, and found to be entirely absent. The amount of substance taken for each analysis was about 30 grammes.

APPENDIX.

ON THE PREPARATION OF PURE IRON.

By A. MATTHIESSEN, F.R.S., and S. PRUS-SZCZEPANOWSKI.

AFTER numerous trials, the general outline of which was given in the report of last year, the following method was found to yield nearly absolutely pure iron, in quantities sufficient for the purpose of this research. Pure dried ferrous sulphate, and pure dried sodium sulphate, are mixed in nearly equal proportions, and introduced gradually into a red-hot platinum crucible. The mass is kept in fusion until the evolution of sulphurous acid gas ceases. The crucible is then allowed to cool, and the fused mass extracted with water. If the heat be properly regulated, the whole of the iron is left as a very fine crystalline oxide. This oxide is thoroughly washed, by decantation, to remove every trace of the sodium sulphate, and, after being dried, is reduced, by hydrogen, in a platinum crucible; the spongy iron thus obtained is then pressed into solid buttons, and melted in lime crucibles with the oxyhydrogen blowpipe.

Before proceeding further, it will be as well to mention the precautions observed in obtaining the raw material in the purest state. The commercial pure ferrous sulphate was freed from every trace of copper by leading sulphuretted hydrogen through the warm acetic acid solution. After filtration, the ferrous sulphate was twice re-crystallised, and dried, first in a water-bath, then in an air-bath. The commercial crystallised sodium sulphate was re-crystallised several times, to get rid of the last trace of chloride of sodium, and then heated on a water-bath to melt the crystals. As is well-known, anhydrous sodium sulphate separates out from this solution, which was scooped out from time to time, dried on an air-bath, and powdered. The purification of the sodium sulphate from chloride of sodium was found to be necessary, owing to the fact that when fusions were made with sodium sulphate containing that salt, the resulting oxide of iron always contained platinum. The hydrogen used for the reduction of the iron, as well as for the blowpipe, was prepared by the action of sulphuric acid on zinc, and purified by leading the gas through two wash bottles—the first containing nitrate of silver and strong nitric acid, and the second caustic soda and acetate of lead—both bottles being half filled with pieces of pumice-stone. The oxygen was prepared by heating a mixture of chlorate of potassium with 15 to 20 per cent of black oxide of manganese, and washed by leading through caustic soda. All connections were made of glass, lead, or pure india-rubber tubing.

The fusion took place in a large platinum crucible (the contents of which are rather more than ½ a litre), enclosed in the usual manner in a clay crucible. The dimensions were such, therefore, that about a kilo. and a half of the mixture could be fused at each operation. After fusion, the crucible is allowed to cool; it is then boiled out with distilled water, and the accumulated product of 6 to 8 fusions washed by decantation with boiling distilled water. The crystalline oxide settles very quickly, and thus allows of a very rapid and thorough washing. The washing was in every case continued several times after the wash waters ceased to give any turbidity with barium nitrate. It is worthy of mention that the above process to prepare pure oxide from the mixture of mixed sulphates yields the purest oxide we as yet obtained. The reduction of the oxide thus formed was made in a covered platinum crucible, heated by means of a large Bunsen burner. The hydrogen was introduced by means of a platinum tube, reaching through the cover to the bottom of the crucible. The gas, purified as described above, and dried by chloride of calcium, was always kept slightly in excess, a constant stream of gas being obtained by not using the generator, but two large gas-holders joined together, the contents of each being about 600 litres (20 cubic feet); two other gas-holders of similar capacity being used for the storage of the oxygen, the one being used to collect the gas from the retort, the other to contain the gas purified by passing it through a strong solution of caustic soda.

The resulting spongy iron was pressed into solid buttons, by means of a strong coining press and a diamond mortar, the cylinder of which being about 70 m.m. in height, the iron, when pressed, forms a cylinder of about 15 m.m. in height, and weighs about 20 grammes. The melting of the compressed iron took place in lime crucibles, the lime having been previously burnt, slacked, and re-burnt, thus forming a fine, impalpable powder, which was compressed in the crucible mould.

The best method of fusion was found to be as follows:—The lime crucible was placed in a slanting position on a piece of lime. One of the oxyhydrogen blowpipes used in the process played on the outside of the crucible whilst the flame of the other was directed inside. When white-hot, a cylinder of the compressed iron was thrown into it. It quickly melts, but at the expense of a large quantity of the iron which is oxidised. The amount lost by the oxidation varies between 25 to 50 per cent. In order to obtain a good solid button of melted iron, it is necessary to cool it in an atmosphere of hydrogen, which is easily obtained simply by turning off the oxygen from the blowpipe playing inside the crucible. The button thus obtained weighs about 15 grammes. On analysis, it was found that the buttons were free from sulphur, phosphorus, silicon, and calcium.

The preparation on a large scale of the pure ferrous sulphate and sodium sulphate was kindly undertaken for

* Read before the British Association, Exeter Meeting, Section B.

us by Mr. J. Williams, who prepared for us more than a hundredweight of each of these substances. We are also indebted to Mr. W. G. Underhay for the use of his large coining press for the pressing of the lime crucibles and the iron buttons.

THE ELECTRO-DEPOSITION OF IRON.

IN the Chemical Section of the British Association, Dr. JACOBI, so well known as the earliest worker in the field of electro-metallurgy, read a paper "*On the Electro-Deposition of Iron.*"

The paper was illustrated by a series of beautiful specimens; among these may be mentioned a medallion of the learned professor, 800 m.m. in diameter. The details of the process were not as full as could be desired. Dr. Jacobi stated that he preferred to employ a dilute solution of the double sulphate of iron and sulphate of potash, soda, or magnesia.

A very low battery power was employed—usually two small Smee's elements.

The moulds may be gutta-percha, wax, or, in fact, any material with which the electro-metallurgist is familiar.

Nature of the Deposit.—The iron has a beautiful lustre, and a silky texture. Exact experiments on its conductivity and tensile strength have yet to be made.

Employment of the Electro-Iron in the Arts.—As we have already stated, Dr. Jacobi showed specimens of great beauty of iron so deposited. Examples of mediæval art of extreme intricacy may be faithfully re-produced; the tone of the metal being well adapted for a purpose of such interest.

In addition to the above, there were many stereotypes. Examples of the process of heliography were illustrated by impressions taken from electro-deposited iron plates. To this process the form of metal is singularly applicable.

The patent rights have been secured; and the extreme importance of the process in a commercial point of view cannot be too strongly insisted upon.

In conclusion, we may mention the result of some curious experiments given by Dr. Jacobi.

A rod of wax was first coated with a thin film of copper, and on this the iron was deposited. The rod was surrounded by a helix of copper-wire, through which a current of electricity was passed. The deposit of iron produced was magnetic, and the metal was deposited in fine fibres at the poles, the tube being of a fine, close texture. The fine particles of iron followed the lines of the magnetic curve.

It may also be stated that the electro-deposited iron possesses the power of occluding twenty times its volume of hydrogen gas. Dr. Jacobi stated that further experiments were necessary to confirm this.

ON A REMARKABLE STRUCTURAL APPEARANCE IN PHOSPHORUS.*

By CHARLES TOMLINSON, F.R.S., F.C.S.

THE following remarkable appearance in phosphorus was described to me some months ago by Mr. James John Field, F.C.S., who requested me, if possible, to account for it:—

About four years ago, Mr. Field placed about half a dozen sticks of phosphorus in a cylindrical jar containing water, which rose about ½ an inch above the ends of the sticks, and the jar was closed with a bung. This jar was placed in a cellar, where it remained undisturbed for about three years. The cellar is flagged with stone, is surrounded by damp walls, and almost entirely protected from light and currents of air. The maximum temperature probably did not exceed 50° or 55° Fahr.

After this long repose, the jar was taken into the laboratory, when it was found that the level of the water had sunk to about one-third of its original height, and the liquid left in the jar had become as dense and thick as the strongest syrup: it consisted of a solution of PO_3 and PO_5.

The portions of phosphorus that rose some inches above the liquid, instead of being cylindrical as before, were conical, from a sharp point to the full diameter, and each cone had a double spiral running down from left to right, as if two flat tapering bands of the substance had been made to cohere at right angles lengthwise, and then twisted into pointed rods, or just as if the sticks had been mounted in a screw-cutting lathe, geared to cut a coarse, tapering double spiral. The sticks had also changed from the creamy, opaque surface to a translucent, barley-sugar appearance, from the surface of the liquid up to the points.

In attempting to explain the appearances described, we must consider—*first*, the wasting away of the sticks, and their conical form; and, *secondly*, the twisted structure.

First. The wasting away of the sticks, and their conical form, are clearly effects of slow combustion, diminishing in intensity downwards. The continued combustion, and also the evaporation of the water, must have been due to a badly-fitting cork, which, during a falling barometer, allowed a portion of the moist air to escape from the jar, and, during a rising barometer, allowed a portion of comparatively dry air to stream in. Had the jar been subject to considerable variations in atmospheric temperature, the effects would have been more rapid; but, as the temperature of the cellar was pretty constant, there is nothing to detain us here. Going back, then, to variations in atmospheric pressure, the level of the water in the jar would be gradually lowered during the oscillations of the barometer, until at length the tops of the sticks of phosphorus became exposed. Slow combustion would then set in; the resulting acid would go into solution, and small quantities of fresh air would stream in to supply the partial vacuum, and so continue the action. During a falling barometer, nitrogen and moisture would stream out of the jar, the level of the water would be again slightly lowered, and a fresh portion of phosphorus be exposed to the attacks of the next portion of oxygen drawn in. In this way, by very slow degrees, the liquid would be lowered, and fresh portions of phosphorus exposed. Those already out of the water would be attacked by every ingress of air, and, thus being acted on, not only more energetically, but also for a longer time, than the lower portions, they would necessarily have a conical shape. Moreover, the air that streamed into the jar would gradually lose its oxygen in descending, so that the lower portions would be acted on less strongly than the upper. The phosphoric acid, as generated, would also pass into solution with a certain rise of temperature, and a certain expansion of the nitrogen left in the jar. As this cooled down, a little more air would be drawn in, and combustion and solution would go on as before. But the most energetic action would be made when, under a falling barometer, a quantity of moist nitrogen streamed out of the jar; and, during a rising barometer, a fresh supply of atmospheric air streamed in, as already explained.

Secondly. As to the spiral markings: these cannot have been formed by any action that took place in the jar; but they show, I think, the new and interesting fact that the curves which the theory of hydraulics assigns to liquids flowing from an orifice, and producing the *vena contracta*, actually form part of the structure of a body suddenly arrested in its flow by being made solid.

It is well known that, in the ordinary manufacture, phosphorus is formed into sticks by being made to flow from a *head* or reservoir of the molten element along a short pipe or *ajoutage* into cold water—or, rather, as soon

* Read before the British Association, Exeter meeting, Section B.

as the stick of phosphorus begins to emerge from the warm *ajoutage*, and shows itself in the cold bath, it is seized by hand, and cut off at intervals, or drawn out by machinery into a continuous length, so that from 15 to 20 lbs. and upwards of phosphorus can be moulded in less than a quarter of an hour.

Now of course in the flow of the molten phosphorus Torricelli's theorem applies—viz., that particles of a fluid, on escaping from an orifice, possess the same velocity as if they had fallen freely *in vacuo* from a height equal to that of the fluid surface above the centre of the orifice. If the head of phosphorus were not too deep, there would be seen immediately over the orifice a hollow depression, which increases until it becomes a cone, or funnel, the centre or lowest point of which is in the orifice, and the liquid flows in lines directed towards this centre. In this condition of the liquid, a rotatory motion is necessarily imparted to it, and this rapidly increases, because all the particles are approaching the centre, and, by virtue of their inertia, they tend to maintain the same velocity which they had in a larger circle, so that their angular velocity (or the number of revolutions in a given time) is constantly being increased. As the particles approach the orifice, they converge to a point beyond it, so that the liquid in escaping is narrower or more contracted at the point to which it converges, than it is either before it arrives at that point or after it has passed it. But, as this point in the phosphorus to which the rotatory lines converge, though fixed in or near the tube, is being constantly shifted in the phosphorus by being drawn out and moulded in the tube, the converging lines, also, are drawn out, and thus give the appearance of a double spiral. Of course, some of the lines are obliterated by the moulding action of the tube, and are probably of a different texture as to hardness as compared with the drawn-out lines. These flattened or moulded portions first yield to the action of slow combustion, and leave the harder drawn-out lines in relief.

ON THE

MEASUREMENT OF GASES AS A BRANCH OF VOLUMETRIC ANALYSIS.*

By W. J. RUSSELL, Ph.D.
Lecturer on Chemistry at St. Mary's Hospital Medical School.

At present, the measurement of the amount of gas given off during a reaction has been but little, if at all, used as a means of quantitative analysis. This has arisen from the want of some simple and easy way of collecting the gas evolved. In a paper read before the Chemical Society last year, I showed how carbonates might, with very considerable accuracy, be estimated in this way; and, since then, I have used the same method for determining the atomic weights of nickel and cobalt. This form of volumetric analysis is of more general application than might at first sight appear probable, and will, it is believed, in certain cases, be found of considerable importance. Having no standard solutions to prepare and keep in order is an obvious advantage; the gas apparatus, once in order, is then always ready for any kind of analysis in which gas is evolved; the reactions made use of, as a rule, take place rapidly; and the volume of gas, as far as the measurement of it is concerned, can be effected with very considerable accuracy. The amount of material used is generally very small, and the whole analysis occupies but a very short time, and can be very easily performed.

The form of apparatus used for collecting and measuring the gas has been already described in the *Journal of the Chemical Society* for August of last year. The following analyses, which have been made by this process, may be of interest as illustrations of the method:—

When carbonic acid is the gas evolved, it is obviously necessary to have as small a quantity of liquid present as possible, to prevent loss by absorption. A specimen of calc spar, which, theoretically, should contain 44·00 per cent of CO_2, gave, when dissolved in a mixture of two parts of nitric acid and one part of water:—

1st experiment,	43·93	per cent of	CO_2.
2nd ,,	43·92	,,	,,
3rd ,,	43·90	,,	,,
4th ,,	43·97	,,	,,
5th ,,	43·89	,,	,,

Another specimen, dissolved in two parts of hydrochloric acid and one part of water, gave:—

1st experiment,	43·89	per cent of	CO_2.
2nd ,,	43·90	,,	,,
3rd ,,	43·90	,,	,,
4th ,,	43·84	,,	,,
5th ,,	43·90	,,	,,
6th ,,	43·85	,,	,,

In all these experiments, 1·2 c.c. of the dilute acid were used.

Some pure sodic carbonate, dissolved in 1·3 c.c. of two parts of water and one part of hydric sulphate, gave 41·48, 41·52, and 41·50 per cent of CO_2. Theoretically, 41·51 per cent should have been obtained.

An experiment with hydric chloride, instead of hydric sulphate, gave 41·52.

The strength of any acid is easily estimated by simply reversing this process, that is, taking a known weight of the acid and an excess of carbonate.

The reaction which takes place when manganic peroxide is heated with sodic oxalate and hydric sulphate, serves for the estimation of the amount of manganic peroxide present, every atom of oxygen liberated corresponding to two atoms of carbonic acid. A specimen of manganese gave—

1st experiment,	58·16	per cent of	MnO_2.
2nd ,,	58·10	,,	,,

A specimen of potassic permanganate, dried at 100°, gave the following results (100 parts of permanganate yield 139·24 of CO_2):—

1st expt. found	136·70,	corresponds to	98·17	p.c.	$K_2Mn_2O_8$.
2nd ,,	136·00	,,	97·69	,,	,,
3rd ,,	136·63	,,	98·13	,,	,,

Potassic bichromate is another salt which can be easily analysed in the same way, by heating with the sodic oxalate.

Potassic bichromate yields 89·49 per cent of CO_2; a specimen of the salt gave—

1st expt.,	88·48 p.c. CO_2,	corresponds to	98·87	$K_2Cr_2O_7$.
2nd ,,	88·57 ,,	,,	98·97	,,

The same specimen, more strongly dried, gave—

1st expt., 88·62 p.c. CO_2, corresponds to 99·03 $K_2Cr_2O_7$.

Interesting and important results may be obtained by dissolving metals in acids, and measuring the volume of hydrogen evolved. A specimen of zinc dissolved in dilute hydric chloride gave—

1st expt.,	3·053	p.c. H,	corresponds to	99·22	p.c. zinc.
2nd ,,	3·051	,,	,,	99·16	,,
3rd ,,	3·050	,,	,,	99·13	,,

A specimen of electro-deposited zinc, which had been subsequently fused, given to me by Mr. Walenn, gave—

1st expt.,	3·060	p.c. H,	corresponds to	99·45	p.c. zinc.
2nd ,,	3·054	,,	,,	99·26	,,

Another specimen of electro-deposited zinc gave—

1st expt.,	3·032	p.c. H,	corresponds to	98·55	p.c. zinc.
2nd ,,	3·033	,,	,,	98·57	,,
4rd ,,	3·033	,,	,,	98·57	,,

0·1832 grm. of the commercial powdered zinc was dissolved; it gave a volume of hydrogen corresponding to

* Read before the British Association, Exeter meeting, Section B.

only 81·98 p.c. of metallic zinc. A specimen of what is sold as pure powdered zinc gave hydrogen corresponding to only 69·22 per cent of zinc.

With nickel and cobalt, the same process is applicable, and has been used for determining their atomic weights. The results have been communicated to the Chemical Society, and will be published in the *Journal* of the Society.*

The following results have been obtained with different specimens of iron:—

Dr. Matthiessen gave me what he believed to be a specimen of pure iron; it gave—

1st expt., 3·571 p.c. H, corresponds to 100·00 p.c. iron.
2nd „ 3·568 „ „ 99·93 „

Steel piano-wire (No. 10) gave—

1st expt., 3·444 p.c. H, corresponds to 96·45 p.c. iron.
2nd „ 3·445 „ „ 96·49 „

Some of the same wire was dissolved, and the amount of iron estimated by Penny's process.

1st. expt. gave 97·8 p.c. iron.
2nd „ 98·2 „

Mean.

Hydrogen process, 96·47. Penny's process, 98·00

This gives a suppression of hydrogen corresponding to 1·53 per cent of iron.

Cast-iron filings gave—

1st expt., 3·375 p.c. H, corresponds to 94·50 p.c. iron.
2nd „ 3·366 „ „ 94·27 „

When tested by Penny's process, the filings were found to contain 97·0 per cent of iron; this gives a suppression of hydrogen corresponding to 2·62 per cent of iron.

A specimen of grey crystalline pig-iron gave, when dissolved, a volume of hydrogen corresponding to only 89·04 per cent of iron.

A piece of magnesium ribbon evolved an amount of hydrogen corresponding to 99·18 per cent of metal.

The foregoing results will serve simply to indicate the kind of results which have been obtained by this form of volumetric analysis.

ON JARGONIA.†

By H. C. SORBY, F.R.S.

I HEREWITH send, for exhibition at the Chemical Section, what I believe to be nearly pure zirconia, and jargonia prepared by a modified combination of the methods described by Mr. David Forbes and myself. You will notice, at once, that the zirconia is perfectly white, whereas the jargonia is of a clear straw-colour. This exactly corresponds with the difference between the opaque borax blowpipe-beads heated to redness, as described in my paper in the *Proceedings of the Royal Society*, and I am strongly inclined to believe that it is a characteristic peculiarity. At first, I thought it might be due to the presence of a small quantity of iron, since zirconia, containing a little of the peroxide, is of a similar yellow colour. When, however, that is digested in sulphide of ammonium, it quickly turns to a deep green colour; whereas this yellow jargonia does not turn at all green. Subsequent experiments may show that the colour is due to some other substance; but, taking all the facts now known into consideration, it seems extremely probable that, after ignition, jargonia is of a clear straw-colour, paler than that of tungstic acid, but deeper than that of ceroso-ceric oxide.

* See CHEMICAL NEWS, vol. xx., p. 20.

† Extract from a letter to Mr. Crookes, read before the Chemical Section of the British Association, Exeter meeting.

MISCELLANEOUS.

British Association for the Advancement of Science.—The following is a complete list of the papers which were brought before Section B (Chemical Science) at the Exeter Meeting:—

Herbert McLeod.—*Report on the Determination of the Gases Existing in Solution in Well Waters.*
A. Matthiessen.—*Report of the Committee on the Chemical Nature of Cast-Iron.*
M. Jacobi.—*On Electrolytic Iron.*
J. Moffat.—*On the Phosphorescence of the Sea and Ozone in Connection with Atmospheric Conditions.*
J. Moffat.—*On the Oxidation of Phosphorus and the quantity of Phosphoric Acid Excreted by the Kidneys in Connection with Atmospheric Conditions.*
C. Tomlinson.—*On a Remarkable Structural Appearance in Phosphorus.*
B. H. Paul.—*Report on Treatment and Utilisation of Sewage.*
F. Braby.—*On Extraction of Ammonia from Gas Liquor.*
Stevenson Macadam.—*On the Economic Distillation of Gas from Cannel Coal.*
Walter Weldon.—*On the Manufacture of Chlorine by means of Perpetually Regenerated Manganite of Calcium.*
T. L. Phipson.—*On some New Substances Extracted from the Walnut.*
T. L. Phipson.—*On the Solubility of Lead and Copper in Pure and Impure Water.*
W. J. Russell.—*On the Measurement of Gases as a Branch of Volumetric Analysis.*
C. Tomlinson.—*On the supposed Action of Light on Combustion.*
Crace Calvert.—*On the Amount of Soluble and Insoluble Phosphates in Wheat Seed.*
H. Sorby.—*On Jargonia.*
S. Williams.—*On the Action of Phosphoric-chloride on Hydric-Sulphate.*
J. Dewar and G. Cranston.—*On Some Reactions of Chloro-Sulphuric Acid.*
A. Matthiessen and C. R. A. Wright.—*On the Action of Hydrochloric Acid on Morphia and Codeia.*
T. Andrews.—*On the Absorption Bands of Bile.*
M. Janssen.—*Methode Spectrale pour la recherche des Composés du Sodium.*
M. Janssen.—*Sur le Spectre de la Vapeur d'Eau.*
W. C. Roberts.—*On a specimen of Obsidian from Java.*
W. D. Michell.—*Are Flint Instruments of the First Stone Age Found in the Drift?*
E. C. C. Stanford.—*A Chemical Method of Treating the Excreta of Towns.*
H. Bamber.—*On the Water Supplies to Plymouth, Devonport, and Exeter.*
P. Spence.—*On the Production of Higher Temperatures by Steam of 212° Fahrenheit.*
A. Oppenheim.—*On Bromo-iodide of Mercury.*
A. Oppenheim.—*On Benzoe-sulphuric Acid.*
Professor Jellett.—*On a Method of Determining with Accuracy the Ratio of the Rotating Powers of Cane Sugar and Inverted Sugar.*
Dr. Fritsche.—*Notes on Structural Change in Block Tin.*—Communicated by W. C. Roberts.
H. Cooke.—*On the Registration of Atmospheric Ozone in the Bombay Presidency, and the Chief Causes which Influence its Appreciable Amount in the Atmosphere.*
J. Lowthian Bell.—*On the Decomposition of Carbonic Oxide by Spongy Iron.*

Report of the Committee for Recommending Increased Facilities for Scientific Investigations.—The following is the report of the "Committee for Recommending Increased Facilities for Scientific Investigations:"—Your committee, having sought the council of many of the most eminent men of science of the United King-

dom upon these questions, so far as it was found practicable to do so, and having carefully deliberated thereon, have arrived at the following conclusions:—I. That the provision now existing in the United Kingdom of Great Britain and Ireland is far from sufficient for the vigorous prosecution of physical research. II. It is universally admitted that scientific investigation is productive of enormous advantages to the community at large; but these advantages cannot be duly reaped without largely extending and systematising physical research. Though of opinion that greatly increased facilities are undoubtedly required, your committee do not consider it expedient that they should attempt to define categorically how these facilities should be provided for the following reason:—Any scheme of scientific extension should be based on a full and accurate knowledge of the amount of aid now given to science, of the sources from which that aid is derived, and of the functions performed by individuals and institutions receiving such aid. Your committee have found it impossible, with the means and powers at their command, to acquire this knowledge. A formal inquiry, including the inspection of records to which your committee have not access, and the examination of witnesses whom they are not empowered to summon, alone can elicit the information that is required, and, as the whole question of the relation of the state to science, at present in a very unsettled and unsatisfactory position, is involved, they urge that a royal commission alone is competent to deal with the subject. Your committee hold that this inquiry is of a character sufficiently important to the nation, and sufficiently wide in its scope, to demand the use of the most ample and most powerful machinery that can be brought to bear upon it. Your committee therefore submit, as the substance of their report, the recommendation that the full influence of the British Association for the Advancement of Science should at once be exerted to obtain the appointment of a royal commission, to consider—(1). The character and value of existing institutions and facilities for scientific investigation, and the amount of time and money devoted to such purposes. (2). What modifications or augmentations of the means and facilities that are at present available for the maintenance and extension of science are requisite; and (3). In what manner these can be best supplied.

Place of Meeting for Next Year.—At the meeting of the General Committee, on Monday last, it was decided that the meeting next year should be held in Liverpool, under the presidency of Professor Huxley, F.R.S., &c.

Death of M. Leiber.—We regret to learn the sudden demise of M. Leiber, the founder of the *Moniteur de la Photographie*, and the *Encyclopédie Photographique*, one of the kindest and most intelligent of the scientific publishers of Paris. His establishment, the Librairie Centrale des Sciences, in the Rue de Seine, has, for the last fifteen or twenty years, been the daily resort of the most eminent men of science; and his extensive knowledge of the older chemical and physical opuscules (memoirs, papers, notes, reprints, &c.) published in France, Germany, England, and America, caused him to be frequently consulted by literary men and authors of scientific works. His loss will be keenly felt by a very large portion of the enlightened Parisian public. Among the foreign works issued by him in French, we may notice the excellent little treatise on "Electricity," by Sir William Snow Harris, and De Filippi's charming "Letters to my Daughter on Terrestrial Creation."

Molybdenum and Chromium.—These metals can, according to Loughlin, be easily prepared as follows:—A mixture of one part of pure molybdic acid and one and a half of cyanide of potassium is placed in a porcelain crucible, and the lid luted on; this is placed in a large crucible, and the interstices having been packed with animal charcoal, the entire arrangement is exposed to a strong white heat for twelve hours; when cold the inner crucible is found lined with a white silver-like metal not acted upon by hydrochloric acid, but readily dissolved by nitric acid, and having a specific gravity of 8·56. By substituting oxide of chromium for molybdic acid metallic chromium is obtained.—*Engineer.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, vol. lxix., No. 6, August 9, 1869.

This number contains the following papers and communications:—

Evaporation of Water by Plants.—M. Dehérain.—The author states—(1) the evaporation of water from the leaves of plants is a function entirely different from the evaporation of the same fluid from a not living (inert) surface, since the evaporation from leaves of plants is not interrupted by the state of saturation of the atmosphere; (2) this evaporation is especially due to the action of light; (3) those rays of light which are most effectual in aiding the decomposition of carbonic acid by the leaves are also those which chiefly assist the evaporation of water therefrom.

Non-Poisonousness of Coralline.—M. Guyot.—This paper contains the results of an exhaustive series of experiments by which it is fully proved that coralline, neither when taken internally even in large doses nor also when brought directly into the blood, is a poison, and that its use in dyeing is not dangerous, provided, at the same time, poisonous substances are avoided.

Some Phenomena of Decomposition Produced by Sunlight.—M. Morren.—The author, while repeating some of Professor Tyndall's experiments, but applying, instead of electric light, the bright sunlight of Marseilles's clear sky, has discovered that several inorganic substances are decomposed when a ray of sunlight is made to pass through them; among these sulphurous acid gas is enumerated, this gas being decomposed into oxygen and vapour of sulphur. This phenomenon is caused, according to the author, by a peculiar dissociation called into play by the vibratory motion of the light, which has the effect of breaking up the chemical combination; by means of spectrum analysis the author has discovered that the activity of the light in this aspect depends partly upon its colour, and partly upon the refringence and the nature of the decomposed substance. The author has also found that a thin layer of sulphate of quinine of no more than 4 or 5 m.m. thickness entirely arrests the chemical rays, as if it were a thick yellow-coloured piece of glass. The author states that the chemical effects of highly-heated platinum—for instance, the decomposition of water by that metal, are due to the accumulation of more and more refringent rays.

On the Laws which Rule the Part any Substance Plays between Two Solvents.—M. Berthelot.—This paper is, on account of the abstruseness of the subject treated of, and also because of the algebraic mode of treatment, not very well suited for abstraction with due justice to the author and the subject.

Heat Developed by the Combustion of Coal.—MM. Scheurer-Kestner and Meunier.—This paper is a continuation of a former paper on the same subject by the same authors. The coals treated are those from the Creuzot and some Belgium coals; as an instance of the composition in 100 parts of the former we quote the analysis of a sample designated anthracitic by the authors:—Water, 1·76; carbon, 87·36; hydrogen, 3·47; ash, 3·63; oxygen and nitrogen, 3·75. Belgian coal from Denain, in 100 parts—water, 1·14; carbon, 77·68; hydrogen, 4·10; oxygen and nitrogen, 10·73; ash, 6·35. The observed quantity of heat of combustion of the first-mentioned sample amounts to 9409 units; that of the last mentioned sample amounts to 9085 units.

Succinate, Benzoate, Nitrite, and Nitrate of Isopropyl.—M. R. Silva.—The succinate of isopropyl is a liquid exhibiting an agreeable but very peculiar smell; insoluble in water, soluble in alcohol and ether, inflammable at a higher temperature, boils at 228°, its specific gravity at 0° is 1·009 and at 18° 0·997. Benzoate of isopropyl is also a liquid exhibiting a very pleasant smell; insoluble in water, but soluble in alcohol and ether; boils at 218°, its specific gravity at 0° is 1·054, at 25° 1·013. Nitrate of isopropyl is an inflammable, slightly yellow-coloured, liquid, boiling at 45°; specific gravity at 0° 0·856, and at 95° 0·844. Nitrate of isopropyl is a colourless, very inflammable liquid, boiling between 101° and 102°; specific gravity at 0° 1·054, at 19° 1·036; its vapour detonates violently when strongly heated.

Transport of Artificially-Made Ice.—M. Toselli states that a solid block of ice weighing 23 kilos., and made in 18 minutes by a process invented by him, has been sent from Paris to Algeria, and received there without more than a very trifling loss by melting during this long journey in hot summer weather.

A large number of papers and communications in this number again refer to the Newton-Pascal and Chasles Leverrier controversy.

Bulletin de l'Académie Impériale des Sciences de St. Petersbourg, Vol. xiv., No. 1.

This number contains the following papers relating to chemical science :—

Evolution of Ammonia Gas from Mushrooms.—M. El. Borscow.—The author says that, many years ago, the late Professor Sachs observed that when a glass rod, moistened with dilute hydrochloric acid (specific gravity, 1·12) was brought near vigorously and healthily growing mushrooms, there appears a white vapour, evidently due to the formation of chloride of ammonium. This fact has been confirmed by Dr. G. Lehmann, while the late Alexander Von Humboldt stated that mushrooms constantly give off, not only ammonia, but also hydrogen. The author of this paper has thoroughly investigated this subject, taking due care to eliminate all sources of error from his experiments by every precaution modern science can suggest and successfully apply. Several engravings would be absolutely necessary for the proper understanding of these researches; but we briefly notice the following results:—(1) different kinds and species of mushrooms give off, while growing vigorously, weighable quantities of ammonia; (2) this evolution of ammonia is not confined to full-grown mushrooms only, but also to the young individuals, and even to some varieties of mushroom spawn; (3). this evolution of ammonia is a proper function of the living organism of these cryptogamic vegetables, and is very little, if at all, influenced by exterior causes; (4) there is no direct relation between the quantity of ammonia and that of carbonic acid given off during a given period of time. The quantity of ammonia given off during a certain length of time bears no direct relation to the weight of the substance from which it is given off.

Malöwka Coal.—M. G. Von Helmersen.—This is a geologico-mineralogical account of researches made in the Tula-Kalugaer coal district, Ural Mountains, Russia. Although the coal seam here alluded to is not suitable for working, its discovery is remarkable on account of its occurrence in the so-called Devonian system, wherein coal seams have not been hitherto found. The author does not speak of the quality of this coal, nor does he give any account of its physical or chemical properties. The paper enumerates the layers and thickness of the various kinds of rocks bored through for other mining purposes, when accidentally this coal was found.

Influence of Temperature upon the Capacity of some Metals of Conducting Heat.—M. Lenz.—The results of the author's experiments may be briefly stated. (1) the capability of conducting heat and electricity are proportional to each other when the temperature is the same; (2) the influence of temperature upon the capability of conducting electricity and heat is the same. In this point the author's results differ from those obtained by Messrs. Angström and Forbes.

On Urinylic Acid.—Dr. N. Sokoloff.—The author made nitrous acid gas pass through a mixture of 100 grms. uric acid and 300 c.c. of water at 70°; a very tumultuous reaction took place, and a large quantity of carbonic acid and nitrogen gases was evolved. The chief result of this reaction is the formation of a new acid, which the author calls urinylic acid, $C_5H_7N_7O_4$; it is a tribasic acid. The alkaline salts of this acid are very readily soluble and crystallise; the lime and baryta salts are insoluble in water and insoluble also in acetic acid; the urinylic acid itself is a yellow-coloured, strongly acid-reacting crystalline powder, difficultly soluble in water. When this acid is heated with nitric acid (specific gravity 1·30) and care taken to avoid further heating after the acid is dissolved, there is deposited from the fluid, on cooling, a new acid crystallising in needle-shaped crystals and converted by nitrous acid into a substance akin to alloxantin, but not further investigated by the author.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, April, 1869.

Among a series of essays and papers read at the meetings of this society, we find the following communications relating to chemistry :—

On the Substances which agree with (entsprechen) Essential Oil of Mustard and are Isomeric with Hydrosulphocyanic Ether.—Dr. A. W. Hofmann.—The author first briefly refers to a former paper on this subject, wherein he treated on the combined action of water and a high temperature upon the essential oil of mustard; he next states that when, instead of water, alcohol is made to act at a temperature of from 110° to 120°, the ether of a peculiar acid is readily obtained. The author, dividing his subject into several sections, treats—(1) on the action of ethyl alcohol on *ethylsenföl* (ethylated essential oil of mustard); (2) on the action of ethylmercaptan upon ethylcyanide; (3) action of ethylmercaptan upon *ethylsenföl*; (4) action of alcohol upon *allylsenfol* (allylated-essential oil of mustard); (5) action of alcohol upon *phenylsenfol* (phenylated essential oil of mustard); (6) action of ethylmercaptan upon phenylsenföl. We regret that, with due justice to the contents of this lengthy essay and its eminent author, we cannot enter into more details on this subject.

Contribution to our Knowledge of Methyl-Aldehyde.—Dr. A. W. Hofmann.—The author first briefly reviews his former communications to the Academy on this subject; he next refers to the labours of MM. Aimé Girard, Geuther, and Butlerow, and discusses the question whether the substance called dioxymethylen by M. Butlerow, is identical with the methyl-aldehyde directly obtained from methyl-alcohol (pure wood spirit) when its vapours are carried along with air over a red-hot platinum wire, placed in a combustion tube. The author states that dioxymethylen, which fuses at 152°, and boils at a higher temperature, cannot be considered to be the normal methyl-aldehyde, CH_2O. The author's paper is chiefly written with the view of elucidating the true bearing and relation of normal methyl-aldehyde towards other compounds which are either polymeric or isomeric with it. The paper is too lengthy and too concisely written to admit of more abstraction.

Polytechnisches Journal von Dingler, second number for July, 1869

This number contains the following original papers :—

Researches on the Necessity of Water Supply to the Vital Functions of the Yeast Cells.—M. Wiesner.—The quantity of water contained in the living yeast cells varies from 0 to 80 per cent, but it appears that the proper functions of these minute organisms do not begin to be exerted unless they contain at least 13 per cent of water, and the greatest activity of these cells requires undoubtedly 40 per cent of water. When water is gradually withdrawn from these cells, either by drying under a desiccator, or even by a slowly rising temperature up to 100°, their vital activity is not thereby destroyed or impaired. Yeast containing only 13 per cent of water induces, in fluids containing from 10 to 20 per cent of sugar, fermentation as intensely as yeast which contains from 70 to 80 per cent of water; alcohol kills yeast, *i.e.*, impairs its capability of inducing fermentation by rapidly withdrawing the water necessary to the existence of the yeast cells. Too concentrated solutions of sugar act upon the yeast cells in the same way, and hence no fermentation can take place therein.

China Grass.—M. Unger.—This material, or fibre, is obtained from the *Urtica Nivea*, L. It is akin to cotton made up of single cells; the diameter of the fibre averages 0·05 m.m.; in air dried state this substance contains 6·52 per cent of water, but if the material is left for twenty-four hours at 20° in a space saturated with aqueous vapour, the quantity of water increases to 18·15 per cent; the quantity of ash of the dried fibre amounts to 1·70 per cent.

Peru Gum.—M. Beckerhinn.—Under this name there is brought into commerce a powder, which, according to the researches of this author, consists almost entirely of small particles possessing, when seen under the microscope, an organised texture. This texture appears to be entirely soluble in water; chemical examination of this substance gave the following results for 100 parts :—Water, 12·72; gum soluble in water, 24·27; substances soluble in alcohol, 48·69; soluble in ether, 4·16; insoluble in water, alcohol, and ether, 4·25; ash, 4·82.

Gum from Moringa Pterygosperma.—MM. Wiesner and Beckerhinn.—This gum was first brought to Paris in the year 1867, under the name of *gomme de ben-ailé*, from one of the French settlements in Hindostan. Its aspect is not unlike Senegal gum; in 100 parts it consists of—Water, 11·71; soluble in alcohol, 8·30; soluble in ether, 7·85; soluble in water, 24·85; insoluble in water, alcohol, ether, 43·86; ash 1·81.

Annalen der Physik und Chemie, von Poggendorff, 1869, No. 7.

This number contains the following original papers :—

Spectra Exhibited by some Gases when Under High Pressure.—M. A. Wüllner.—This paper is the continuation of a monograph on this subject, the publishing of which commenced in this periodical two volumes back. It is an excellent essay, but, owing to its great length, is not well suited for useful abstraction.

Floating and Expansion of Liquids upon Liquids.—M. Lüdtge.—In the introduction to his essay, the author says, the first fact which gave rise to the scientific study of the phenomena observed when a drop of oil, for instance, falls on water, was that first observed by mariners, of the calming effects of oil poured on the surging waves of the sea in a severe gale of wind, a subject on which an excellent memoir was written and published many years ago by the eminent physicist, M. Van Beek. The author's essay is copiously illustrated by exquisitely executed engravings, but as it is only by the aid of these that the subject matter of this paper can be made intelligible, we must refrain from further notice of the subject.

Some New Antimony Minerals from Wolfach, Baden.—M. Petersen.—A portion of this paper is a geologico-mineralogical essay of local interest chiefly, of the following minerals, of which the chemical composition is given. *Stibiotriargenite*. Specific gravity, 9·611 to 9·770; in 100 parts—Antimony, 27·35; silver, 72·65. *Stibiohexargenite*, Ag_6Sb. In 100 parts—Antimony, 15·84; silver, 84·16. *Coarse-Grained Antimony-Silver*. In 100 parts—Antimony, 23·06; silver, 76·65. *Polyargyrite*. In 100 parts—Sulphur, 14·78; antimony, 6·98; silver, 76·70; lead, a trace; iron, 0·36; zinc, 0·30. *Wolfachite*. In 100 parts—Sulphur, 14·43; arsenic, 38·46; antimony, 13·17; lead, 1·32; silver, 0·12; iron, 3·71; nickel, 29·53; cobalt, a trace; copper and zinc, small traces.

Distances which Limit the Molecular Action of Capillarity.—M. Quincke.—A mathematico-physical essay.

Isodimorphism of Arsenious and Antimonious Acid.—M. P Groth.—A purely crystallographico-mineralogical essay.

Crystallised Kainite Found at Stassfurth.—M. P. Groth.—This paper, also a crystallographico-mineralogical essay, is accompanied by several engravings. Kainite consists, in 100 parts, of—36·34 K_2SO_4; 25·24 $MgSO_4$; 18·95 $MgCl_2$; 19·47 H_2O.

Relation Existing Between Circular Polarisation and Hemiëdric Hemisymmetry.—M. V. Von Lang—Unsuitable for abstraction.

Feeble Electric Sparks in Air.—M. P. Reis.

Vibrations of Luftplatten (thin layers of air).—M. Kundt.—Both these papers are mathematico-physical essays.

Cause of the Galvanic Phenomena of Cooling and Heating Observed by Peltier.—M. Edlund.

How can we Neutralise those Induction Currents which are Generated in the Electro-Magnetic Motors during the Rotation of the Movable Magnets, and Prevent these Currents Weakening the Full Action of the Machine?—Dr. Sinsteden.

Estimation of the Dispersion of Glycerine.—M. Listing.

Experiments made with Holtz's Induction Machine.—M. Schumacher.

Observation on the Treatise of M. R. Most, entitled a New Proof of the Second Law on Heat (Wärmegesetz).—All the papers of which the titles only are quoted are too abstruse for useful abstraction.

Journal de Pharmacie et de Chimie, July, 1869.

This periodical contains, in the first place, three papers which we do not quote, since the subject matter has been already alluded to, taken from the *Comptes Rendus*. The original papers are:—

Double Fluoride of Iron and Sodium.—M. Nicklès.—When a concentrated solution of sesquichloride of iron is added to a concentrated solution of fluoride of sodium, a white precipitate ensues, which disappears on the addition of the slightest excess of sesquichloride of iron. When to this last solution, tepid alcohol is added, a flocculent yellow precipitate is formed, which is also a double fluoride of iron and sodium, with excess of iron. Both these varieties give, on analysis, results which lead to the formula $2NaFl,Fe_2Fl_3,HO$.

New Reagent for Brucine.—M. Cotton.—When, to a solution of brucine in nitric acid, hydrosulphide of sulphide of sodium is added, in concentrated solution, the mixture becomes, first, violet, next green-coloured, provided the alkaloid is in excess. Morphia does not give any similar reaction under the same conditions; alkalies do not affect this colouration; dilute acids render it rose-coloured, while sulphuretted hydrogen is given off; 2 milligrms. of brucine impart, in this manner, a decided colouration, even to half a litre of water.

Recent Researches on the Essence of Roses.—M. Flückiger. Chemically considered, the essential oil of roses, is a mixture of an oil containing oxygen, to which alone the smell and perfume is due, and a solid hydrocarbon, a stearopten absolutely devoid of smell, and composed according to the formula $C_{16}H_{16}$. This hydrocarbon is soluble in chloroform, fuses at 32°, and boils at 272°. Potassium does not act upon this substance; treated with a mixture of bichromate of potassa and sulphuric acid, it yields, faintly, a smell of acroleine; with fuming nitric acid, butyric, formic, fumaric, oxalic, valerianic, and succinic acids are formed.

New Apparatus for the Concentration of Sulphuric Acid.—M. Cotelle.—It is a well-known fact that the concentration of sulphuric acid in platinum vessels is an expensive process, owing to the high price of the first purchase of these apparatus, and the expense attending any soldering or repair. The author has had made a column, lined inside with fire-bricks, and made outside of good ordinary bricks; it rests on a large pedestal. This column is open at both top and bottom; but in these openings are fitted fire-clay stoppers. The inside of this apparatus is fitted with previously-calcined pumice-stone; inside the lower portion of this column, openings are made between the bricks, through which a current of highly-heated air is forced. From the top, the acid which has to be concentrated is made to trickle on the pumice-stone, and, meeting with a current of highly-heated air, the superfluous water is driven off, and the acid, on arriving at the bottom, is in a concentrated state, and runs off in properly-arranged vessels.

The remaining papers in this number are specially devoted to *materia medica* and sciences more closely connected with medicine.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, 1869, No. 11.

This number contains the report of the meeting of this society, held on the 14th of June last. It appears that this society's membership is highly valued beyond Prussia, since no less than nine new foreign members were admitted at this meeting; the following papers were read:—

On Halhydrate Water.—M. Erlenmeyer.—The author says that, many years ago, Dr. T. Graham called attention to the fact that the sulphates of magnesia, of oxide of zinc, of protoxide of iron, of oxide of copper, and the sulphates of the protoxides of nickel and cobalt, contain, besides water of crystallisation, a certain quantity of water, which belongs to, and is essentially required for, their constitution. Professor Graham called it *basic water*, and stated that it could be replaced by salts; at a somewhat later period (now, however, nearly forty years ago) the same *savant* named this water *salinic*, and distinguished between it and *basic water*, inasmuch as for the former may be substituted salts, for the latter bases. Since the year 1838, Professor Dr. J. Von Liebig has called that water contained in salts for which, according to Professor Graham, may be substituted equivalents of other neutral salts, *halhydrate water*. The author of this paper is of opinion that modern chemists have altogether forgotten this matter, and especially since it might inconvenience their mode of representing things; there exists, however, for all that, a great distinction between water of crystallisation and halhydrate water, and the author having carefully studied this point, has come to the conclusion, on theoretical as well as on experimentally proved facts, that the salts which contain halhydrate water are not neutral salts in the ordinary sense of the word, but acid salts in one way, and basic salts in another way—that is to say, they are salts which contain at the base, as well as at the acid, *hydroxyls*, which have not yet reached the formation of anhydride (neutralisation). The author gives instances of his mode of representing this matter, and states that he will shortly publish extensive researches on this subject.

On Betaïn, a New Vegetable Base met with in the Juice of Sugar Beet-Roots (*Beta vulgaris*).—M. C. Scheibler.—The author says, in the year 1866, he published a brief account about a vegetable base met with in the juice of the sugar beet-roots, and which base, on account of its great solubility, becomes accumulated during the sugar manufacture from beet-root juice, in the molasses which result from that process. The author has prepared this base from the freshly expressed juice of the sugar beet-root, as well as from the molasses. The process of separation is, as might be expected from the complex nature of the substances just named, very complicated, and requires the use of phospho-molybdate of soda. Since in this country there do not exist beet-root sugar works, and since large quantities of juice have to be operated upon, we do not enter into the details of preparation, but describe the new base *betaïn*. It is a solid substance, crystallising from its alcoholic solution in large crystals, which are very deliquescent, and contain water of crystallisation, which they lose by drying at 100° or over strong sulphuric acid; the base is very soluble in water, its solution saturated at 25°, has a specific gravity of 1·1177, and then contains 61·8 per cent of the anhydrous base. Betaïn does not affect vegetable colours, is void of smell, and has a sweetish cooling taste. The result of the elementary organic analysis of betaïn dried and fully deprived of all water led to the formula $C_5H_{11}NO_2$; the crystalline air-dried substance has the formula $C_5H_{11}NO_2 + H_2O$. This base yields, with many acids, beautifully crystallised salts, and readily forms well-crystallised double salts with the chlorides of gold and platinum, mercury, cadmium, and zinc. When betaïn is boiled with an aqueous solution of caustic potassa, it is thereby split up into several bases, among which trimethylamin is found. Oxidation of betaïn by means of chromic acid and the action of strong hydriodic acid, both tried in sealed tubes, led to no results of any value. Betain resists the oxidising action of chromic acid.

Contribution to the Mode of the Analysis of the Gold and Platinum Salts of Organic Bases.—M. C. Scheibler.—The author dissolves a weighed quantity of the gold or platinum salt in water, or if it does not happen to be readily soluble therein, keeps it suspended therein, and places it in contact with metallic magnesium, whereby the metals gold and platinum are separated, and hydrogen is at the same time evolved. This operation is carried on at the ordinary temperature, or if the salts are difficulty soluble, on a water-bath; the fluid may be acidified, but not with hydrochloric acid, since the object often may be to estimate chlorine also. The ribbon-like magnesium wire met with in commerce is sufficiently pure for this purpose. The gold and platinum separated during this operation are, by means of careful decantation, freed from the fluid wherein they are immersed, and next transferred to a filter and washed, first with distilled water and next, after the filtrates intended for the estimation of chlorine have been set aside, with dilute hydrochloric acid, in order thereby to remove any excess of magnesium or any magnesia which might remain mixed with, or adhered to, these metals; after having been well purified and dried, the metals are ignited and weighed. The results obtained by this method are very correct.

Occurrence in the Molasses of Beet-Root Sugar of a New Acid Homologous with Asparaginic Acid.—M. C. Scheibler.—This is, as the author states, only a preliminary notice. He says some three years ago, he was occupied in experimenting on the preparation of asparagin, which, according to M. Rossignon's statement, is met with in freshly expressed sugar beet-root juice in quantities varying between 2 and 3 per cent. The author of this paper did not then discover asparagin, but instead thereof he found asparaginic acid; this acid, however, on more close examination, proved to be not the asparaginic acid itself, but an homologue thereof, to which, according to analysis, the formula $C_5H_9NO_5$ belongs. The author further states that he is not as yet enabled precisely to say whether the substance in question is really an homologue of asparaginic acid, or whether it is perhaps only a methylated asparaginic acid—

$$C_2H_3\left[\begin{matrix}CH_3\\H\end{matrix}\right\}N\Big](CO_2H)_2$$

On a Di-carbonic Acid of Sulphur.—M. V. Meyer.—The author of this paper, after entering into some merely speculative discussion, states that he has succeeded in preparing dicarbonthionic ethyl ether, a colourless oily fluid, exhibiting a very characteristic but not very strong smell, boiling at 180°, but not entirely volatile without undergoing decomposition. The dicarbonthionic acid is unknown in free state; the researches on this subject are continued by the author.

Variable Vapour Densities.—M. Aug. Horstmann.—This paper will not admit of proper abstraction with due justice to the subject and the author, a remark which equally applies to the next paper.

Contribution to our Knowledge of Molecular Compounds.—M. Wichelhaus.

New and General Method for the Formation of Nitriles.—M. Henry.—The author of this paper communicates a series of experiments made by him with the view to prove "that the amides when acted upon by pentasulphide of phosphorus, are readily converted into nitriles, while at the same time sulphuretted hydrogen and anhydrous phosphoric acid are formed." The author describes at great length his experiments with acetamide, benzamide, and oxamide, and in each case nitriles are formed with more or less readiness, and accompanied with a larger or smaller quantity of by-products.

On Parachlorotoluidine.—MM. Henry and Radziszewsky.—Parachlorotoluidine, $C_7H_6ClNH_2$, prepared by the authors by means

of a rather complicated process from parachloronitrotoluol, exhibits an oily strongly refractive liquid, the odour of which is akin to that of toluidine; its specific gravity at 18° is 1·175; boils at 236°; combines readily with hydrochloric, sulphuric, and nitric acids, forming therewith solid crystalline compounds. The authors states that this communication is only preliminary, and that their researches on this subject are not yet quite finished.

On Bismuth Silver.—M. Kayser.—When molten bismuth begins to solidify, the well-known phenomenon of the expulsion of a portion of the yet fluid metal from the interior of the partly fluid mass is observed in consequence of the fact that the solidified metal is specifically lighter than the molten and fluid metal; admixture of other metals, while impeding the crystallisation of the bismuth, also impede its expansion on cooling, but all metals do not act in this respect alike, for the addition of about 10 per cent of lead to bismuth entirely prevents its expansion. An alloy of silver and bismuth behaves in a different manner. The author, while working with silver on the large scale, accidentally obtained an alloy of the former metal and bismuth consisting, in 100 parts, of Bi, 56·1; Ag, 43·5. Upon the surface of this alloy were observed a large number of spherical particles of bismuth, measuring from 5 to 10 millimetres diameter, and consisting, in 100 parts, of Bi, 97·6; Ag, 2·355. While the operation of cupellation was being continued and the quantity of silver rose to 60, 70, and 80 per cent, the globules of bismuth expelled contained invariably 2·5 per cent of silver.

On Crystallised Phosphoric Acid.—M. Krämer.—When an aqueous solution of phosphoric acid, the specific gravity of which has been ascertained, and which solution consequently contains a known quantity of water, is so concentrated by evaporation that the remaining acid exactly corresponds to the formula H_3PO_4, this solution, on cooling, solidifies, yielding beautifully prismatic crystals of pure phosphoric acid.

On the Stilben Series.—MM. Limpricht and Schwaner state that the insinuation made against their researches on this subject, and especially the statement made by M. Grimaux, that his communication, on this subject made in 1867 in the *Bulletin de la Société Chimique de Paris*, has been made improper use of by the authors of the paper on the above subject, recently published in this German periodical, is altogether erroneous; they vindicate their rights and priority in this notice.

A Base Homologous with Kyanæthin.—M. Bayer.—In a rather lengthy paper, the author states that he has discovered a substance which he calls kyanmethin, consisting, in 100 parts, of—Carbon, 58·50; hydrogen, 7·35; nitrogen, 34·15; formula, $C_9H_9N_3$. This substance is a crystalline solid, readily soluble in water, less readily so in alcohol and ether, fuses at about 180°, sublimes without being decomposed, forming thereby finely white-coloured needle-shaped crystals; its vapour is very irritating and excites coughing; its taste is bitter and very like that of quinine. This base combines with acids, forming readily crystallisable salts. This base is a product, among others, of the action of sodium upon aceto-nitrile. The hydrochlorate of this base is composed according to the formula $C_6H_9N_3HCl$.

Cosmos, August 7, 1869.

This number contains, among a great mass of useful information not suitable for abstraction in our columns, a paper on the—

Ripening of Grapes by Cutting away part of the Leaves.—M. J. Comte.—At a meeting of the Agricultural Society of Agen, the author called attention to a chemico-physiological fact of great importance. It appears to have been an old custom, and is yet so, to pull off from the vines, especially in the Southern parts of France, a large quantity of leaves, especially close to where the fruit is placed on the stems, so as to allow full sunlight to fall on the grapes, which, in consequence thereof, soon get an amber-yellow colour, and appear to be rather over-ripe. The author condemns this custom; and, while citing, among the older authorities on this subject, MM. Rosier and Chaptal, he states that, as regards the grapes, the presence of the leaves, as arranged by nature, is absolutely necessary to them for perfecting their maturity, which means for converting into grape sugar a portion of the acids present in the unripe grapes in large quantity. The carbonisation (by which word the author understands the addition of carbon to the acids) is effected by the leaves, through which the vegetable juice passes, for the purpose of becoming deoxidised. Fully ripe grapes should exhibit an agreeable green colour; grapes taken from the vine before they were ripe do not reach maturity at all, as other fruit does, but remain as they were. Taking away the leaves, therefore, does not ripen, or speed the ripening of the fruit, but only alters its colour to a shade of yellow, which genuinely ripe grown grapes never present. The taste of these yellow grapes is intensely sour, while that of the green-coloured ripe grapes is extremely sweet. The author regrets that the foolish practice alluded to is not authoritatively prohibited, on sanitary grounds, and for the reason that it is very injurious to the fruit-bearing of vineyards.

Levels of Two Seas.—M. Faye.—As a proof of the correctness of the geodesical survey made in 1798, during the celebrated Egyptian campaign, it may be stated that the author, on re-calculating the results then obtained for the difference in level between the Mediterranean and Red Seas, and comparing the results with those obtained when a survey for the construction of the Suez Canal was made in our time, found the results to be—0·85 metre for 1798, and 0·86 metre for 1866.

Influence of the Intensity of Coloured Light on the Quantity of Gas Set Free by Plants.—M. Prilleux.—It is well known that, under the influence of direct sunlight, the green-coloured parts of plants decompose carbonic acid. The author, in order to learn the effect of rays of light of equal intensity, has applied coloured solutions which could be rendered more or less deep-coloured by adding thereto dye-stuffs, while the intensity of the light was photometrically measured. In the midst of these coloured aqueous solutions, branches of aquatic plants were placed in large glasses filled with water saturated with carbonic acid. The undermentioned figures denote the activity of decomposition of carbonic acid for two kinds of aquatic plants thus exposed during one minute of time. No 1. refers to the *Potamogeton perfoliatus*, Nos. 2 and 3 to *Elecdea canadensis*.

White light	64·75 ..	74·5 ..	51·36
Blue light	56·00 ..	58·8 ..	52·92
Orange light	55·30 ..	57·0 ..	38·00

There may, therefore, be deduced from these experiments that the differently coloured lights do also act differently upon the green parts of plants, and call forth an equal disengagement of oxygen, when the intensity of the light remains the same, and, consequently, all the rays of the solar spectrum cause the decomposition of carbonic acid by plants.

August 14, 1869.

For those interested in very speculative matters, we mention that this number contains, as did a preceding, and as will, in all probability, one or more of the next numbers, an article on the—

Means of Communication between our Earth and the Planets.—M. C. Cros.—We do not enter into the details, as they do not belong to the domain of chemistry or the sciences more immediately connected therewith.

Les Mondes, August 5, 1869.

We quote from this paper the following:—

Chemical Laboratory at Neufchâtel.—This well-known, beautifully-situated little Swiss town, with a population of about 11,000, has obtained an excellently well-arranged chemical laboratory, placed under the direction of Dr. Sacc. There is ample room provided for forty students to work comfortably, and provided with all useful instruments. The building contains lecture-rooms, and every other requisite. The town possesses excellent educational establishments, and is a very healthy place.

Manufacture of Various Objects from Quills.—M. Clegget.—While the southern parts of France, only a few hundred miles distant by rail from Paris, could throw into the trade large quantities of excellent material (home produced), the cost of transport by rail from Toulouse to Paris, for the same weight and bulk, is only two francs less than the enormously long and circuitous journey from Kasan and Nijni-Novgorod to Paris. The article in question, not being one subject to deterioration, requires, of course, no great speed in conveyance. The quills and feathers are sorted; the smallest are used for ornamenting toys, while the better quills are turned into tooth-picks, and nibs for writing purposes, and almost all the rest, except the pith, is used in ornamental-flower making, brush-making, and imitation of horse-hair work. The feathers have recently been woven into a tissue fit for use as carpets, by means of machinery invented by M. Bardin, the owner of the works inspected by the above-named gentleman officially, to see that all hygienic measures are duly carried out.

Researches on the Illumination of Liquids by means of a Beam of Neutral or Polarised Light.—M. Lallemand.—The author describes minutely in this paper a series of minute optical experiments with liquids suitably held in tubes. When a beam of sunlight is made to illuminate different liquids, there are observed various phenomena dependent upon the substance employed, or under observation. In this aspect, liquids are divided into three categories—(1) some do not possess any perceptible fluorescence, and are devoid of rotatory power; (2) they possess more or less fluorescence, and, akin to the first, are devoid of all rotatory power; (3) these fluids have rotatory power, and exhibit, in addition thereto, often a very strong fluorescence. To the first class belong, among other liquids, water, nitric and hydrochloric acids, and liquid ammonia. Samples of second class—Solutions in pure water of salts of quinine, also esculine, and, among pure liquids, perfectly chemically-pure sulphide of carbon. Third class—A concentrated solution of pure cane-sugar may serve as examples.

NOTES AND QUERIES.

Wood Lice.—Oil of turpentine, or, better yet, carbolic acid, especially if care be taken that the latter be pure and colourless, will destroy these insects, without injury to wood-work or furniture, which should be painted over, as it were, with these fluids. If, however, the smell of these substances be objected to, a solution of corrosive sublimate in water, with the addition of some common salt to increase its solubilty, may be applied; but this solution is highly poisonous to men and animals.

Estimation of Phosphates in Manures.—A very valuable communication appeared in the CHEMICAL NEWS (vol. xx., p. 77) on the "Estimation of Phosphates in Manures." Will Mr. Sutton, or any of your other correspondents, inform me if it is possible for a superphosphate to go back or lose any portion of its soluble phosphate and at the same time contain an excess of sulphuric acid? which I believe all commercial superphosphates do in a certain degree.—FARMER.

THE CHEMICAL NEWS.

Vol. XX. No. 510.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Professor Stokes has spoken wisely in defining the object and aim of the British Association as the "giving a more systematic direction to scientific inquiry." Without doubt, this is the paramount design. It is true that the Association serves as a vehicle for the bringing together of scientific men from various parts of England and the Continent, and thereby promotes a fellowship and a good feeling which workers in the same field should ever possess, and which no paper-war should ever disturb; it is true that it often imports pure science into most unscientific regions, and makes, for the time being, the city honoured by its presence, the focus *par excellence* of scientific thought and activity; and in its train there follows a host of fervid devotees who cry aloud to the inhabitants of the honoured city, "What time ye hear the sound of the cornet, sackbut, psaltery, and all kind of music, ye are to fall down and worship the golden image which we have set up," and the people *do* fall down and worship; and papers are read, and lectures delivered, and *soirées* given, and excursions made, and Mayors exercise the most unbounded hospitality, and the people shout "Hail" till they are hoarse, and the Local Committee works like a galley slave, and all for the glory, and honour, and welfare of science. These things help to make up a great whole, but the real and principal *work* of the Association is the "giving a more systematic direction to scientific inquiry," and the granting of sums of money for well indicated and defined purposes of research. It is by this means that the Association really influences the scientific world; it is by this means that it is leaving its impress upon the scientific progress of the age—an impress which will remain clear and distinct when all lesser matters shall have faded away, the men, the times, the very cities which received them, the very countries which gave them birth, each and all more evanescent than "*scientia immutabilis*;" each and all more destructible than facts "*travailles jusqu'à indestructibilité*." Francis Bacon has well compared the modes of research to the three ways of walking in the dark, for a man may either grope about as best he can, or he may be led by the hand of another, or he may direct his steps by a lantern, the last applying to the trying of experiments in definite order, with a determinate design, and in accordance with recognised laws of thoughts, and surely the Association both holds a lantern and leads by the hand when it gives "a more systematic direction to scientific inquiry."

There is no denying the fact that the year which has passed has not been brilliant in scientific results; yet it has been a year for much steady work. It is notable rather as a time for collecting particulars than as a time for the formation of generalisations. It is not that Nature has piped unto us and we have not danced,—it is not that we have ceased to torment phenomena by every known process which can lead to the revealing of secrets, but rather because there can never be a succession of great and notable discoveries or developments either in philosophy, or art, or science; an uniform progression either for good or for evil is an impossibility, and we must neither desire nor expect it. We may well rest content with our extended knowledge of the constitution of the sun as the dominant scientific result of the year which has intervened since the meeting of the British Association was held in Norwich.

ON THE MANUFACTURE OF CHLORINE BY MEANS OF PERPETUALLY-REGENERATED MANGANITE OF CALCIUM.*

By WALTER WELDON, F.C.S.

Since the last meeting of the British Association, chlorine has begun to be manufactured extensively by a process which depends on the production and perpetual regeneration of a compound no mention of which, so far as I can find, as yet exists in chemical literature. As this process, besides thus producing and continually re-producing what I believe to be a new compound, reduces, by fully 80 per cent, the principal item in the cost of the manufacture of chlorine, greatly increases the quantity of chlorine which can be practically obtained from a given quantity of hydrochloric acid, and, moreover, enables the manufacture of chlorine to be carried on without the production of any offensive residue, I have ventured to think that a very brief account of it might not be without interest to this Section.

What has hitherto been the ordinary process of manufacturing chlorine consists simply in digesting with hydrochloric acid ores containing peroxide of manganese. The reaction which takes place, besides liberating chlorine, produces chloride of manganese, which remains behind in solution after the chlorine has gone off, and has hitherto been usually thrown away. There have been proposed and tried a great number of processes for transforming this chloride into peroxide for use over again; but the only one of them which has met with the slightest measure of practical success, prior to that which is the subject of this paper, is the one which is known, from the name of its inventor, as Dunlop's process. Dunlop's process decomposes the chloride of manganese by heating its solution, under a pressure of from two to four atmospheres, with milk of carbonate of lime, and then, in the dry way, transforms the resulting carbonate of manganese into a mixture or compound of two equivalents of peroxide with one equivalent of protoxide, by subjecting it for forty-eight hours to the action of air at a temperature of about 600° Fahr. The product of Dunlop's process is a sufficiently satisfactory one, containing about 72 per cent of MnO_2; but the process requires a very formidable amount of apparatus, and, in this and other ways, is so costly that its use has never been extended beyond a single firm of manufacturers.

Three years ago, I began to endeavour to work out the idea of decomposing, by either lime or magnesia, the chloride of manganese in the residual liquors of the chlorine manufacture, and then blowing air through the resulting mixture of hydrated protoxide of manganese with solution of chloride of calcium, or of chloride of magnesium, as the case might be. I took for granted that one-half of the protoxide of manganese so treated was the largest proportion of it that could thereby be converted into MnO_2—in other words, that one could obtain only sesquioxide by this method; but it was soon found that,

* Read before the British Association, Exeter meeting, Section B.

when using lime to decompose the chloride of manganese, considerably more than half the protoxide operated upon was frequently converted into MnO_2. It was found, eventually, that more than half the protoxide was thus peroxidised only when more lime was used than simply the quantity necessary to decompose the chloride of manganese, and when what was treated with air was thus a mixture of protoxide of manganese and lime; and it was also found that in all such cases there was a definite relation between the quantity of lime associated with the protoxide of manganese and the quantity of the protoxide, in excess of half, which became peroxidised. This led to the discovery that, whereas when protoxide of manganese by itself is treated with air in the wet way, one-half is the maximum proportion of it which can thereby be converted into MnO_2, the association of a certain proportion of lime with the protoxide so treated will enable the whole of it to become converted into MnO_2. It is to this fact, together with that of the much greater rapidity with which protoxide of manganese can be peroxidised by treatment with air in the wet way when lime is present than when lime is not present, that the practical success of the new method of manufacturing chlorine is mainly due.

The action of lime in increasing the proportion of protoxide of manganese which can be peroxidised by treatment with air in the wet way evidently consists in the lime substituting itself for that part of the protoxide which, when protoxide of manganese not having any other basic substance associated with it is treated with air in the wet way, does not undergo peroxidation. It would seem that the production of MnO_2 in the wet way by direct combination between hydrated MnO and atmospheric oxygen absolutely requires the presence of a base with which the MnO_2 can combine as it forms. When protoxide of manganese not having any other basic substance associated with it is treated with air in the wet way, a part of the protoxide itself has to act as the required base; and this is the reason why, in that case, not more than half of the protoxide can become peroxidised, the other half being required to combine as MnO with the half which becomes converted into MnO_2. When, however, the protoxide of manganese which is treated with air in the wet way has lime associated with it, the MnO_2 which forms (or part of it, according to the proportion of lime present) combines with CaO instead of with MnO, thus leaving free to undergo peroxidation that part of the MnO which, but for the presence of the CaO, this MnO_2 must have combined with, and which would thus have got locked up in a state in which it would have been incapable of being peroxidised, at least in the wet way and by air alone. Hence, the presence of enough lime to take the place of that half of the protoxide which, if no lime were present, would have to go into combination as base, and also to supply enough base for that half itself to combine with after undergoing peroxidation, will enable the whole of the MnO operated upon to be raised to the state of MnO_2. The minimum quantity of lime which is enough for this purpose is an equivalent for each equivalent of MnO operated upon, or the quantity necessary to supply an equivalent of lime to all the MnO_2 which can be produced by the peroxidation of all the MnO.

By treating with air, then, a mixture of protoxide of manganese and lime suspended either in water or in solution of chloride of calcium, there is formed a compound containing MnO_2 and CaO, in the proportion of an equivalent of one to an equivalent of the other. This compound may be regarded as sesquioxide of manganese, or Mn_2O_3, the MnO in which is replaced by CaO. I call it manganite of calcium, and I believe it to be a new compound. Gorgrew, in 1862, described a compound which he called manganite of calcium; but his compound contained five equivalents of MnO_2 per equivalent of CaO, and the CaO in it was so feebly combined that it readily decomposed chloride of manganese. My compound contains only one equivalent of MnO_2 per equivalent of CaO, and has no action upon salts of manganese.

This compound has now been produced and re-produced to the extent of some hundreds of tons. The process of producing it and applying it to the manufacture of chlorine is conducted as follows:—The residual liquor which remains after a charge of manganite has reacted upon hydrochloric acid in any suitable still is run from the still into a well or other receptacle, in which it is treated with carbonate of lime, to neutralise any free acid, and to decompose any sesquichloride of iron or sesquichloride of aluminium which may be contained in it. The neutralised liquor is then pumped up into an elevated cistern, in which it is left at rest for a few hours, in order that it may deposit certain solid matters which it now holds in suspension. The most abundant of these is usually sulphate of calcium, due to the somewhat considerable quantity of sulphuric acid which is nearly always coutained in the hydrochloric acid produced in alkali works; but there are also small quantities of sesquioxide of iron, derived from the sesquichloride of iron in the hydrochloric acid, and sometimes partly from the lime used in the process, and larger or smaller quantities of alumina and silica, due to the lime. These impurities having deposited, the supernatant liquor, which is a mixed solution of chloride of manganese and chloride of calcium, and is now quite clear, and of a beautiful rose-colour, is run off into another vessel, where there is added to it the quantity of lime necessary to decompose the chloride of manganese in it, and nearly an equivalent more. A blast of air is then injected into the resulting mixture, and what was at first a perfectly white mud (all the manganese in which was in the state of MnO) soon becomes a very black mud, nearly all the manganese in which is in the state of MnO_2. This is then allowed to settle for about twelve hours, at the end of which time it has separated into a denser black mud and a supernatant, clear solution of chloride of calcium. This solution of chloride of calcium having been drawn off, what remains is ready for use in the still. It is used as mud, without drying, being conveyed to the still by pipes, and entering by a hydraulic lute. In the still it meets with hydrochloric acid, from which it liberates chlorine, at the same time re-producing exactly such a residual solution as was commenced with. With this solution, the round of operations is re-commenced, and so on, over and over again, continually. The samples I exhibit are portions of a charge of manganese which, at the works of Messrs. J. C. Gamble and Sons, of St. Helen's,—where this process has been worked out, by the liberal co-operation of Lieut. Colonel Gamble, the proprietor of those works, and the invaluable assistance of Mr. Bramwell, the very able manager of them,—has actually generated chlorine from which bleaching-powder has been made, something like fifty successive times.

Hitherto, the principal item in the cost of chlorine has been that for native peroxide of manganese. Last year, in Great Britain, France, Belgium, and Germany together, there were produced about 120,000 tons of bleaching-powder, which cost, on an average, for native oxide of manganese, not much, if any, less than £5 per ton. My process substitutes for this cost for native oxide of manganese a cost for the regeneration of manganite of calcium not exceeding fifteen shillings per ton of bleaching-powder, being about ten shillings for lime, one shilling for steam, one shilling for wages, and two shillings for interest and wear and tear. Moreover, whereas hitherto, at least in this country, and in all but an extremely few exceptional cases, the production of a ton of bleaching-powder has required the acid from about 75 cwts. of salt: my compound yields chlorine enough for a ton of bleaching-powder from the acid from less than 45 cwts. of salt. This larger yield of chlorine is mainly due to the artificial manganite being so easily soluble that it can very readily be caused to neutralise from 95 to 99 per cent of the acid employed, which is a very much larger proportion than can be neutralised when working with manganese ores. A third very important advantage of the new process over the old one consists in this—that, whereas the immense quantities

of acid which escape neutralisation in the old process are usually—and have almost necessarily to be—sent into the rivers as free acid, the only product of the new process which has to be thrown away is a perfectly neutral solution of chloride of calcium.

Seeing that manganite of calcium, or $CaMnO_3$, is only of the very same value precisely in respect of the quantity of chlorine which it can liberate from a given quantity of acid as sesquioxide (otherwise manganite of manganese, or $MnMnO_3$), it may be well to explain why it is preferable to produce and re-produce the former rather than the latter. The reasons for this are two. There is, firstly, the obvious reason that, when all the manganese is converted into MnO_2, twice as much work is done per given bulk of material operated upon as when only half the manganese is converted into MnO_2; and this, of course, would be a very important consideration, even if the transformation of chloride of manganese into manganite of calcium occupied the same time as its transformation into manganite of manganese. Really, however (and this is the second reason), the former operation, in which all the manganese is converted into MnO_2, does not occupy more than one-fifth of the time required for the latter operation, in which only half the manganese is converted into MnO_2; and hence, while the manufacture of chlorine by means of perpetually-regenerated manganite of calcium effects the very considerable economy above stated, it is questionable whether chlorine could be manufactured by means of manganite of manganese regenerated by the same method so cheaply as by means of manganese ores.

The length of time which, when protoxide of manganese by itself is treated with air in the wet way, is required for its complete conversion into sesquioxide is very remarkable, and the fact that hydrated protoxide of manganese is somewhat freely soluble, alike in water and in neutral solution of chloride of calcium, would seem to have something to do with it. It is a curious fact that the peroxidation of protoxide of manganese by treatment with air in the wet way is greatly retarded by the presence in the medium in which the protoxide is suspended of any proto-compound of manganese in the state of solution. Thus, in a solution of either chloride or any other proto-salt of manganese, peroxidation will go on only extremely slowly; and solution of the protoxide itself, which will be present until the very end of the operation when protoxide alone is treated with air in the wet way, has the same retarding influence. On the other hand, when treating with air a mixture of protoxide of manganese and lime suspended in solution of chloride of calcium, there are formed solutions containing peroxide of manganese, in the presence of which peroxidation goes on with extreme rapidity. All these solutions are more or less deeply coloured, solution of the protoxide being without colour. I exhibit a sample of one of the coloured solutions, called by the workmen "the port-wine solution." The nature of these coloured solutions has not yet been fully investigated, but I believe them to consist of manganite of calcium dissolved in solution of oxychloride of calcium.

I may be permitted to mention, in conclusion, that, while there is every prospect, from the rapidity with which the new process of manufacturing chlorine has been and is being adopted both in this country and on the Continent, that, within a period to be measured only by months, nearly all the chlorine made in the world will be made by it, there is every likelihood that, in nearly all cases, a portion of the hydrochloric acid saved by it will be applied to the recovery of sulphur from alkali-waste. The chief reason why the recovery of sulphur from alkali-waste has been so little practised hitherto is that the manufacturers have considered it more profitable to use all their acid for the manufacture of bleaching-powder than to use any part of it for the recovery of sulphur; but the process which I have had the honour to describe will enable them to make even more bleaching-powder than they have made hitherto, and yet have enough acid left to permit of their applying to all their alkali-waste the only process for the recovery of sulphur therefrom which as yet has been found practically successful; and I am able to state that this application of a portion of the acid saved by my process will be extensively adopted.

ON ELECTRIFICATION.*

By THOMAS T. P. BRUCE WARREN.

ELECTRICIANS must have noticed this singular phenomena at the very earliest date of testing; but it is very certain that it has been until now regarded as an unintelligible and uncertain property of an insulator.

The paper read by Mr. Warren has contributed greatly to our knowledge of its effects, so that it no longer remains the inconvenience that it had been to electricians; for he has shown that the laws which it follows admit of being formularised.

We notice that these researches have been carried out on cores of Mr. Hopkin's manufacture, several miles of which were tested under the varied conditions stated by the author. He believes that the very excellence of Mr. Hopkin's insulated wires has enabled him to examine so completely the whole of the subject.

ON THE NEW METHODS OF ESTIMATING THE AMOUNT OF REDUCED PHOSPHATES.

By JOHN HENRY CHESSHIRE.

IN a case recently tried at the Gloucester assizes, a dispute arose whether reduced phosphates could be estimated correctly. Notwithstanding the weighty evidence of Dr. Voelcker and others to the contrary, it was decided in the affirmative, and it was proved by the results of a series of experiments, conducted by men of equal scientific attainments, who pronounced my method (the bicarbonate of soda process) to be the one upon which the greatest reliance could be placed.

The plan I propose is as follows:—Take 1 grm. superphosphate, extract the soluble part. To the residue add 5 grms. bicarbonate of soda, ½ of a litre of cold water, and boil from two to three hours; filter, wash, &c. To the filtrate add hydrochloric acid in excess, then tartaric acid and the magnesia mixture in the usual way.

I now propose to tabulate a series of experiments, showing, side by side, the results of the oxalate of ammonia, and the bicarbonate of soda processes.

No. 1. Action of 10 grms. bicarbonate of soda on 1 grm. Bedford and Cambridge coprolite, with a ½ of a litre of water, and boiling for two hours—soluble phosphate = 0·97 per cent.

No. 2. Action of 5 grms. bicarbonate of soda on 1 grm. Bedford and Cambridge coprolite, with a ½ of a litre of water, and boiling for two hours—soluble phosphates = 0·69 per cent.

No. 3. Action of 5 grms. bicarbonate of soda on 1 grm. (so-called) gypsum, with a ½ of a litre of water, and boiling for two hours—soluble phosphate = 0·83 per cent.

No. 4. Action of oxalate of ammonia on 1 grm. gypsum, with a ½ of a litre of water, and boiling for half an hour—soluble phosphate = 0·97 per cent.

No. 5. Action of 5 grms. bicarbonate of soda on 1 grm. gypsum, with a ½ of a litre of water, and boiling for two hours—soluble phosphate = 8·98 per cent.

No. 6. Action of oxalate of ammonia on 1 grm. gypsum, with a ½ of a litre of water, and boiling for half an hour—soluble phosphate = 8·45 per cent.

* Abstract of a paper read before the British Association [illegible] meeting, Section A.

No. 7. Action of 5 grms. bicarbonate of soda on 1 grm. steamed bone, with a ½ of a litre of water, and boiling for two hours—soluble phosphate = 0·69 per cent.

No. 8. Action of oxalate of ammonia on 1 grm. steamed bone, with a ½ of a litre of water, and boiling for half an hour—soluble phosphate = 2·18 per cent.

No. 9. Action of 5 grms. bicarbonate of soda on 1 grm. guano, with a ½ of a litre of water, and boiling for two hours—soluble phosphate = 1·25 per cent.

No. 10. Action of oxalate of ammonia on 1 grm. guano, with a ½ of a litre of water, and boiling for half an hour—soluble phosphate = 2·11 per cent.

I obtained these results, 4, 6, 8, 10, by taking care to have only a slight excess of oxalate of ammonia at the end of the half hour's boiling.

Nos. 1 and 2.—My usual results with bicarbonate of soda have been only ½ per cent, but, as ½ a milligramme makes a difference of about 1-14th per cent, the results are practically the same.

Nos. 3 and 4.—The so-called gypsum is the waste after the soluble phosphate has been extracted from a superphosphate made from a mineral phosphate. It contained 12·57 per cent unacted-upon phosphate.

Nos. 5 and 6.—A superphosphate made from Bedford coprolite. I extracted the soluble portion, and worked on the remainder for the reduced. It contained 2·01 per cent unacted-upon coprolite.

Nos. 9 and 10.—A sample of good guano, which I boiled for half an hour, filtered wash, &c., and worked on the remainder for the reduced.

You will see by these experiments that you can distinguish between reduced phosphates and unacted-upon coprolite; and, if Mr. Hughes will take care to have only a slight excess of free oxalate of ammonia at the end of half an hour's boiling, his results will not be so high.

83, Newhall Street, Birmingham,
August 20th, 1869.

ON THE

EXAMINATION OF WATER FOR ORGANIC MATTER.*

By R. ANGUS SMITH, Ph.D., F.R.S., &c.

(Continued from p. 30.)

There are two columns giving the amount of oxygen required by the Clyde water. One giving the grains is correct, but, in altering the mode of expression, an error occurred not in the original. The amount in the 2nd is in 100 millions.

Having had occasion to examine another stream, very slow, rather a canal, receiving sewage, and flowing about twenty miles, the following results were obtained with the chameleon:—

Oxygen Required by the Decomposed and Decomposing Matters.

Grains per gallon.	
2·835	1·205
1·249	1·630
1·949	1·205
1·170	1·453
0·425	0·425
0·815	0·177

The gradual diminution of the decomposed organic matter is here seen very plainly. As new sewage comes forward in certain places, the amount rises.

These numbers correspond entirely with the apparent condition of the stream; they do not, however, correspond with the total volatile matter, which was as follows:—

Volatile matter.	Fixed matter.
9·33	44·27
6·23	28·91
3·99	24·08
3·08	36·75
3·43	31·85
4·16	30·31
5·22	29·92
5·04	69·30

I believe the results obtained by the chameleon are more useful in a sanitary point of view than the other results.

Let us take another case.

When heavy rains drove the impure water forward, the chameleon gave the following:—

Oxygen in Grains per Gallon Required for the Decomposed and Decomposing Matter.

0·992	1·106
0·284	1·134
0·638	1·276
0·709	1·347
0·992	

In such a case, the ordinary analysis gave—

Volatile matter.	Fixed matter.
4·20	20·72
4·48	21·21
7·14	26·39
6·02	34·02
4·27	28·28
4·69	32·27

These latter do not at all show the fine distinctions made by the permanganate, which agrees entirely with our senses, and may be used instead of them for putrid substances.

The permanganate must be used with consideration, like all other chemical tests. We must be careful that there are no lower metallic oxides in the water, which will remove the colour as suddenly as the sulphuretted hydrogen from putrid matter. Much has been said against the permanganate; but nothing even pretends to do what it does. Those who neglect it leave out the putrid matter, or drive it off in boiling. If it is used as the only reagent the results are certainly without value.

Nitrites decompose chameleon instantly. They are the result of the oxidation of azotised matter, and must be estimated.

The decomposition of the chameleon may be caused by the organic matter present, or by nitrites, &c. The presence of nitrites or nitrous acid will show if the organic matter is only recently oxidised.

Generally, there may be found organic matter and nitrites together, showing that some is oxidised and some ready to become so.

Schönbein has found traces of nitrous acid in the efflorescence of walls. In judging of the time, we must make allowance for this, and not judge from small traces such as he alludes to.

When nitrites and organic matter are found together, they may be estimated separately: the chameleon will be decomposed by both. 158 of chameleon solid is equivalent to 95 of nitrous acid, or 1000=606. It will be necessary to find one of the substances separately, and to subtract it from the whole, in order to find the amount of the second.

The amount of nitrous salts may be found by using ozone-paper, that is, paper with iodide of potassium and starch. The water to be tried is made acid with a little dilute sulphuric acid—not more than three drops to 1000, and a drop put upon the paper. If nitrous acid is present, it becomes blue. This blue is obtained immediately by putting a drop of the solution on ozone-paper when there is 1 of NO_3 in 30,000 of water; and, by waiting patiently, and giving time, it may be seen with much less.

* From vol. iv., 3rd series, of the *Memoirs of the Literary and Philosophical Society of Manchester*. (Communicated, with emendations and alterations, by the author).

In order to find how much nitrite is in water, the solution may be diluted until the reaction ceases to be distinct, even after waiting. The amount in the water will then be 1 in 100,000. If, in another case, when we find the reaction distinct in water, we take 100 grains and add 900 to it and find it beginning to be indistinct, the undiluted quantity must have been ten times as strong as the diluted. The amount in the 1000 grains is 1 in 100,000; the amount in the 100 grains is ten times as great, or 1 in 10,000; and thus we may arrive sufficiently near to the total amount. The amount of water added in order to bring the reaction to the adopted minimum is the measure of the strength of the solution.

A test like this depends partly on the eye and partly on the delicacy of the test-paper. The same result will be attained if the same eye and tests are regularly used.

The method of testing with paper is not so refined as the use of a larger amount of water—say 1000 to 10,000 grains. With this amount, the presence of 1 of NO_3 in 3¼ millions of water may be detected on adding starch and iodide of potassium. Three drops of sulphuric acid are also added to the 1000 grains, *i.e.*, 3 grains by measure. If no nitrous acid is present, no blue colour will be seen with this amount. If nitrous acid is present, the colour will begin in a few seconds. Some may prefer one way, and some the other. I do not look on this as quantitatively very exact; I simply thought it a useful method. Some more work is required.

The methods given of estimating the amount of nitrous acid are minimetric, proceeding by dilution instead of concentration. The value with gases is better known than in liquids; but it is believed that it will be sufficiently exact with the latter in cases where pure scientific accuracy is not attainable and not necessary, and where it is important to save time, labour, expense, and patience.

Now suppose 1000 of the water decolourise 5 of chameleon, we must subtract from 5 the amount which would be due to the NO_3, which then would give the amount of chameleon solution decomposed by the organic matter.

The estimation of both is interesting; but it is much more important to obtain the total chameleon used, as the presence of NO_3 must be considered a great objection to water, partly on its own account, and chiefly because of its origin.

It is to be observed that water containing much animal matter becomes extremely acid. It is a common thing to find water extremely clear, with no apparent organic matter; even on standing, also, extremely acid, and retaining nitrates. I have found it so filled that it appeared to flow less readily than pure water, and had a most nauseous taste. It was close to a churchyard, and was considered excellent water. This perversion of taste is difficult to understand, but it must be combated; it is not natural, and causes illness and death. This acid water is an excellent solvent of metals; and, if lead is present, the solution becomes rapidly so strong as to taste of the metal. This acidity, in conjunction with nitrates, does not, so far as I know, exist when the organic matter is very old—probably because the organic acid is oxidised. Some of it—probably all—is caused by the formation of organic acids. Similar organic and entirely colourless solutions, acid, but free from nitric acid, may be found by allowing peaty water to stand, without evaporation, but in contact with the air, for some years.

In the nitrous waters, no organic matter will be apparent on burning, unless there is more than the acid can oxidise. A very white ash is, therefore, a suspicious circumstance; and, unless the matter is extremely free of organic matter, this white ash is a certain indication of nitric acid. If there is a great deal, the ash melts readily. By white is meant white as soon as it is incinerated.

These acid nitrous waters contain phosphates generally. Phosphate of lime, or even alumina and iron, may be precipitated from them by ammonia, if they are direct from animal matter, and have not passed through porous matter sufficient to deprive them of some of the less soluble substances.

There are many interesting questions to be asked regarding nitrates. I am inclined to think that their presence shows that the most dangerous state of the organic matter is past. When they appear in any solution, the chief escape of putrid gas seems to have ceased; the water may, however, be still dangerous to use, and, of course, is revolting to the imagination. It will be well to examine how far these suspicions are correct. When complete nitrification has occurred, all that class of evils arising from organic matter direct are prevented.

This paper was written for a special purpose, and does not pretend to say all that may be said regarding organic matter in water. As to the purification, there are many points to be observed. It has been generally held that nitric acid is the ultimate form which nitrogenous substances of organic origin assumes; but we must remember that plants have the power of decomposing nitrates, and of using the nitrogen for their own purposes. There are conditions, therefore, in which the organic matter may be entirely removed from water; and, when we remember how readily soils absorb phosphates and potash, we easily see why common salt should chiefly be left. The oxygen of the nitrates may even be used for the purification of water, whilst the earthy salts and phosphoric acid are precipitated. This operation of decomposing the nitrates seems to be the final one which is at hand for purifying water, and probably explains the marvellous results we frequently see. This decomposition is performed by living plants apparently; but some observations seem to indicate that the effect may be produced by the organic dead matter in water. The nitrites found in plants by Schönbein may possibly have been formed from the nitrates by deoxidation.

Animal and Vegetable Matter—The Common Salt of Sewage.

This subject deserves a further separate treatment.

As animals are formed out of vegetables, the elements which compose each are of course the same; and even the proximate organic principles are difficult to distinguish, especially in a state of decomposition. Still, it is remarkable what a clear insight is given into the quality of water by simply boiling down a few thousand grains and burning the residue. We can, by the eye and the smell, detect humous or peaty acids, nitrogenous organic substances and nitrates, and estimate their amount to a very useful point of accuracy. There may be times when this is the only experiment that can be made. After doing this, and trying other methods many hundred times, I still return to it as delicate, and little liable to fail. The want of numerical results is a serious objection, rendering the plan unfit for use when public reports are to be made of the analyses; but it is an excellent guide for the chemist in his laboratory: we may even decide by it the animal or vegetable origin of the matter.

This, however, is not enough; we require to obtain some knowledge of the quantity as well as of the quality, and we even require to know something of the previous history of the water, supposing decomposition to have gone so far that nothing definite can be affirmed as to the organic substances. It has already been shown that the carbon and the nitrogen may entirely disappear, the phosphorus may be precipitated, and the sulphur be, to a large extent, removed, nothing whatever remaining of the original substances, except alkalies, some of the alkaline earths, and chloride of sodium, or common salt. The latter, in reality, is the only substance which, so far as I know, is neither dissipated nor precipitated in whole or in part, potash excepted. The common salt, therefore, may be taken as an indication of the amount of original or organic matter, if we subtract from it any portion which we know to have appeared originally connected only with inorganic substances.

Perhaps all natural waters contain common salt;

although rain, in a quiet day, and in a clear district, is nearly free from it, possibly, in some places, entirely so. In passing through the soil, it always collects some chlorides; some of these are the measure of the amount of vegetable matter decomposing in the soil. If we were to estimate the amount of chlorides dissolved by the water alone out of the inorganic soil, and subtract that from the total, we should obtain the amount dissolved by the action of vegetation breaking down the rocks or soil allowing for rain also. If the organic matter were decomposed, the common salt would still flow down the streams, and tell its tale. These quantities, however, vary excessively on every soil, and in every climate, and with every wind, and degree of wind.

The common salt which comes down our streams comes from the wear and tear both of animals and vegetables in the process of living. We cannot tell which comes from the animals and which from the vegetables.

From pasture-land, and land generally, the greatest amount is from vegetation; and, if we collected the organic matter, we should find also there that vegetation gave the greatest amount of matter, except from recently-manured fields, or when the water comes from shallow or surface drains, where the land had upon it a good deal of animal matter.

When, however, we come to towns, or great collections of animals, the chlorides, as well as the organic substances with which they are allied are the products mainly of changes taking place in animal life. Let us compare the amount of chlorides to be found in plants and in animals.

Chlorides in the Blood of Animals (Nasse and Poggiale in Gmelin) *as Chloride of Sodium in* 1000 *parts.*

Dog	4·490
Cat	5·274
Horse	4·659
Calf	4·804
Goat	5·175
Sheep	4·895
Rabbit	4·092
Swine	4·281
Goose	4·246
Hen	5·396

If we take the ashes, the amount is, according to Stölzel,

For ox blood	51·190
For ox flesh	4·860
Ashes of the serum in man*—	
Chloride of sodium	61·087
Chloride of potassium	4·085
The ashes of the blood in man	57·641
The ashes of the blood of the horse, according to Lehmann	67·105
Urine	22·972

But, as the latter is produced so rapidly and frequently, it is the greatest and most constant source of common salt. No plant can be compared with animals in this respect.

Chlorides in Vegetable Matter.

Ashes. Name of Plant.	Chloride of Sodium.						Chloride of Potassium.					
Wheat grain	0·27	0·55	0·64	1·60	0·34	Way and Ogston.						
In the whole ash		10·00	Weber.									
Ripe oats. Grains		0·92	0·07	0·45	1·24	Way and Ogston.						
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Buckwheat straw	4·55	3·01	3·19	3·75	3·38	1·69 E. Wollf.	7 41	26·93	0·77	3·13	6·85	9·70 E. Wollf.
Barley straw with chaff		3·07	5·68	2·14	4·37		.. ..	0·90				
			5·56	Way and Ogston.								
Barley grains	0·56	1·44	0·41	0·61	0·72	1·59 ..	.. ..	1·29				
			2·01	.. ..			.. ..	1·93		Way and Ogston.		
Ripe oat straw, Middle			3·03									
„ „ Bottom			15·36	J. P. Norton.								
Radishes. Root			10·89	Herapath.								
Chestnut.												
Young wood								9 67				
Green shell								15·42	2·20	Wollf.		
Asparagus		7·97	Schlienkamp.		12·94	T. Richardson.						
Tea	2·40	2·15	2·25	4·66	3·25							
	Spooner.		Twis.	Hague.	Homes.							
Orange-tree. Root			1·18									
„ „ Stem			0·25	Rowney and Blow.								
Beech		6·68	0·62	Witting.								
Birch		7·17	9·84	Witting.								

When animals decay, they must, according to the above analyses, give out much more common salt than the same amount of vegetable matter; and this we find to be the case in the drainage of grave-yards. But it is from living animals we find the greater amount of common salt: that which goes into the blood is rapidly thrown out; and, as we take with our food amounts varying from 100 to 250 grains of common salt per day—let us say 150, an equal amount must be abstracted from us. It is for this reason sewage water constantly is found to contain common salt, increasing according to the amount of sewage. For this reason, common salt is found in the saltpetre of all countries. It is a part taken from the blood of the dead or the living animal, remaining with the nitrogen unchanged, even when the organic matter has been so

* Robin and Verdeil's "Traité de Chimie Anatomique."

highly oxidised that nitric acid takes the place of albumen.

Pure spring, or very fine stream water, gives only a slight precipitate with nitrate of silver. This has a bluish tinge, not being dense enough to become white. When there is more than this slight precipitate, nitric acid is generally found, especially if the water has passed through porous materials.

These tests must be used and the inferences drawn with great discretion. We know that near the sea there may be found a certain amount of chlorides in the springs, rising, according to circumstances, until the water becomes brine. The same thing occurs near great deposits of salt, such as in Cheshire and elsewhere. There are, also, saline wells scattered over most countries, the origin of whose chlorides is quite unknown to us. There is in the rain driven violently from the sea an amount of common salt sufficient, on crystallising, to dim the windows of houses many miles inland. In manufacturing towns where coal is burnt, the rain contains more chlorides than rain in the country. Many large districts of tropical countries contain nitrates and common salt in the soil, but these salts in all probability result from oxidised animal matter. Chlorides are found in some districts in this country rather in excess of the average from superficial causes. But notwithstanding all these exceptions, which appear for the moment numerous, I must still consider that the test is one which may be generally used.

In England it is almost universally the case that the presence of much chloride in drainage water indicates drainage from animal matter, and no water containing chlorides to a great extent ought to be used without careful examination as to the source. One grain per gallon is too much, and is, in many places, to be suspected of being caused by impure drainage. Of course we must in this case, as in all inquiries, be careful that no disturbing causes intervene. In this country chlorides may be given out from manufactories, in which are constantly made chemical experiments sufficiently large to interfere with our accuracy, if we are not very careful.

It may be supposed here that I am adding many qualifications, but the same may be done in the case of nearly all experiments. No experiment is of value, unless it is viewed on all sides to prevent the admission of errors, and I do not know that more care is required in this case than in many others. In the case of chlorides we learn readily the average amount in a district, either in the rain or the drainage, and we detect the smallest increase. Any amount of common salt above the average of the district obtained in a well in a city or camp, or near habitations of men or animals, is an almost certain proof of impure drainage; when the clue has been followed up, I have found the origin in a sewer or some such spot, times without number and for many years. The presence of the sea or manufactories, or of disturbed strata with mineral waters, will seldom, after all, cause any error with a careful person.

Nitrates are very common in small quantities. They are found in water from manured land, in gardens, wells near houses, and, as a consequence, in nearly all town wells; in great abundance near churchyards, if the drainage is direct. They are not necessarily found in sewage which has not flowed through strata. The amount from the atmospheric sources is so minute that it will not interfere with any inquiry regarding the wholesomeness of water at present.

Although caution must be exercised in drawing conclusions from the presence of the chlorides, their absence may be held as conclusive against the presence of decomposed animal matter, and excretions of animals in large quantities.

If chlorides and nitrates are found together in water, we may take it for granted that animal matter has existed there, or does exist in the water. Of course a very rigid scientific inquiry shows at once that vegetable matter may be present, especially from grain or seeds; but, practically, this need not affect the question, especially in a sanitary point of view, because, if this accumulation of vegetable matter occurred capable of giving as much nitrogen as animal matter, it would be sufficiently, and perhaps equally, hurtful when putrid.

If chlorides and nitrates are found in water still capable of decomposing chameleon, the presence of animal matter, or injurious gases or nitrites, may be assumed, a part only being oxidised.

If the chlorides and nitrates are present, but the power of decomposing chameleon absent, then animal matter in a putrefying state is absent, but whether it disappeared minutes or ages before is not shown by chemistry.

The chloride of sodium in a sewage stream of a very sluggish nature was estimated. The following numbers were obtained in a course of 14 miles:—

8·97	7·93
7·53	7·78
6·25	6·62
7·78	40·89

The numbers are pretty uniform, although they rise and fall with evaporation and the additions made to the stream; but whenever certain manufactures come in a sudden rise is observed. Before this occurs, I believe the chloride of sodium is a perfectly exact comparative measure of the amount of sewage. It may, in many cases, also be made into a positive measure. This will, however, depend on the mode of managing the sewers.

The conclusion simply is, that chloride of sodium is the most abiding constituent of sewer water, and, with due precaution, the best index of comparative amounts in the original sewage. When decomposition has not taken place, it may also be used for indicating the comparative strength or value of sewage water.

Perhaps it will be thought that in here speaking of the impurities of water, when the River Commissioners are making their inquiry in Lancashire, it would be better if I spoke less of the laboratory side of the question, and more of the great evils which have destroyed the beauty and use of our rivers. On one important point I am of the same opinion which, years ago, I expressed in this Society—that we waste an enormous amount of water. We throw into a stream, without compunction, impurities which will destroy the value of many hundred times, or, perhaps, thousand times, their bulk; and this evil may, to a certain extent, be cured with our present knowledge. We try in vain to take out that which we have thrown in. A large part of the evil can be cured by little trouble, although I confess that there is much remaining which demands more time and space than is everywhere conveniently found. Time and space, although by many treated as mere forms of thought, are expensive in Lancashire.

The following may be regarded as a summary of the results required for sanitary purposes:—

1. Quality of the organic matter.
2. Condition of the gases of decomposition.
3. Organic matter: easily-decomposed organic matter, and slow to decompose.
4. Nitrates as remnants of organic matter.
5. Nitrites.
6. Chlorides, with precautions, as indicating animal sources when greater accuracy is wanted.
7. Oxygen of the dissolved air as indicating the activity of the decomposition.
8. Total organic matter.

(This the author found by weighing).

9. The usual inorganic analysis, to be spoken of in a second paper.

The author considered that, for purely sanitary purposes, the Nos. 1, 2, 3, and 6 were the most important.

The organic matter may be divided into many parts; nitrogenous into several parts; and carbonaceous into several. The total nitrogen has been taken by Dr. Frankland very carefully, and the mode of taking oxides of nitrogen improved. The division of the nitrogenous into separate parts has been begun by Wanklyn. The carbonaceous has not been much studied of late years.

ON SOME NEW SUBSTANCES EXTRACTED FROM THE WALNUT.*

By Dr. T. L. PHIPSON, F.C.S.

Between the shell and the kernel of the walnut there exists a thin membrane, called the episperm, which closely envelopes the cotyledons, and is composed here, as in most other fruits, of a double membrane, the inner one being very thin, quite white, translucid, and perfectly devoid of taste, whilst the external one is much coarser in structure, more or less coloured, has a very bitter, disagreeable taste, and contains the substances mentioned in this paper.

When the episperm of the walnut is digested for several hours in alcohol, it yields a yellowish liquid, from which a notable amount of gallic acid, ellagic acid, and a new species of tannin, which I will call *nucitannic acid*, or *nucitannin*, can be obtained. The latter is the principle to which the thin walnut skin chiefly owes its disagreeable bitter taste; and this nucitannic acid possesses the property, when boiled for several hours with dilute hydrochloric acid, of splitting up into *glucose* and a red substance, which I will call *rothic acid*, the composition and properties of which I have fortunately been able to determine, although I started on this research last season with a very small supply of walnut skin.

Nucitannin is soluble in water and in alcohol, very slightly soluble in ether; it precipitates solution of gelatine, but not exactly like ordinary tannin does. The mixture solidifies only after a little time. It forms insoluble salts with lime and oxide of lead, and is left as a kind of yellow varnish, devoid of crystallisation, when its alcoholic solution is evaporated at a moderate temperature. Its composition has not yet been ascertained.

When an aqueous solution of nucitannin is boiled for eight or nine hours with dilute hydrochloric acid, the pale yellow liquid becomes more and more red, until it finally assumes a tint similar to that of a dilute solution of permanganate of potash. It is then allowed to cool, when the red substance, rothic acid, separates, along with some gallic acid and ellagic acid; these are collected on a filter, and the clear liquid which passes is found to contain glucose and gallic acid.

Rothic acid is separated from the other substances by a dilute solution of ammonia, and re-precipitated by hydrochloric acid; a second treatment gives it quite pure. It is a brownish red amorphous substance, combining readily with ammonia, potash, lime, &c.; its lead-salt is remarkable by being insoluble in cold acetic acid. Rothic acid is very soluble in alcohol; its solution exercises no particular action on the spectrum; it yields no absorption bands; it is, also, very soluble in ammonia. Dried at 100° C., it was found to lose water for a long time; it was, therefore, heated in an oil-bath to 118° C., and then burnt with chromate of lead. The analysis gave:—

		Calculated for $C_{28}H_{12}O_{14}$.
Carbon	57·81 ..	57·52
Hydrogen	4·16 ..	4·11
Oxygen	— ..	38·37

The lead-salt was formed by precipitating acetate of lead with an alcoholic solution of rothic acid; it forms an olive-coloured amorphous precipitate, which becomes brown when dried in the air, and appears quite black when dried at 100° C. It leaves metallic lead when calcined carefully in a porcelain crucible. 370 milligrms. of rothate of lead yielded, to analysis, 150 milligrms. of lead, or 40·5 per cent.

Calculated for $C_{28}H_{12}O_{14},2PbO$.	Found.
Lead, per cent .. 40·2	40·5

The lime-salt of rothic acid forms a brownish precipitate, obtained by adding an ammoniacal solution of chloride of calcium to a solution of rothic acid. It is like the lead-salt in appearance, but contains only one equivalent of base:—

$$C_{28}H_{12}O_{14},CaO.$$

The rothates of potash, soda, and ammonia are soluble; the rothate of silver forms a fawn-coloured precipitate, which becomes darker on drying, but does not appear to be very sensitive to the action of light.

Rothic acid is a member of a rather numerous class of bodies, some of which are mentioned below:—

$C_{28}H_{12}O_{14}$ = 1 eq. rothic acid.
$C_{28}H_{12}O_{20}$ = 2 ,, gallic acid.
$C_{28}H_6O_{16}$ = 1 ,, ellagic acid.
$C_{28}H_8O_{16}$ = 2 ,, rufigallic acid.

Somewhat similar substances extracted from oak-bark, quinine bark, root of *Tormentilla erecta*, &c., appear, on analysis, to contain C_{26} instead of C_{28}.

I will reserve for a future occasion, an account of the preparation, properties, and composition of pure nucitannin; I may briefly state, however, that the alcoholic decoction of the walnut skin contains a substance described here as nucitannin, yielding, by the action of mineral acids, rothic acid, gallic acid, ellagic acid, and glucose; and, since ordinary gallotannic acid may be represented as a glucoside, yielding 3 eq. of gallic acid—

$$S\left\{\begin{matrix}G\\G\\G\end{matrix}\right\}-8HO,$$

it is possible that nucitannin may be—

$$S\left\{\begin{matrix}R\\G\end{matrix}\right\}-xHO,$$

in which R represents rothic acid, and takes the place of 2 eq. of gallic acid. If so, there is another tannin present in the walnut skin, an *ellagic tannin*—

$$S\left\{\begin{matrix}E\\G\end{matrix}\right\}-xHO,$$

which explains the fact that alcohol takes up, from the walnut skin, a substance yielding a notable amount of ellagic acid, these glucosides being all very soluble in alcohol, though the acid derived from them may be very much less soluble.

* Read before the British Association, Exeter meeting, Section B. Abstract by the author.

NOTICES OF BOOKS.

Abridgments of Specifications Relating to Acids, Alkalies, Oxides, and Salts. A.D. 1622—1866. Printed by order of the Commisioners of Patents. London, 1869.

We have here before us, condensed into a neat volume containing about 1100 small octavo pages, a most useful as well as a most valuable record of the history and course of inventions on the domain of practical and technical chemistry for a period of nearly two and a half centuries. The number of specifications, from the earliest period to the end of the year 1866, amounts to no less than 59,222.

This work, besides embracing all inventions relating to the making or obtaining by any direct or indirect methods of acids, alkalies, oxides, or salts, includes inventions relating to the making or obtaining of several elementary bodies; among which are bromine, iodine, chlorine, fluorine, carbon, hydrogen, nitrogen, oxygen, and sulphur, and some compounds—as, for instance, cyanogen.

There is in this excellent work such an *embarras de richesse* as regards the subjects for quotation that it is very difficult to make a choice out of such an abundance of matter. For curiosity's sake, we quote, from the first page, the following:—

A.D. 1623, February 23, No. 23.—Jones, Roger, and Palmer, Andrewe, "Makeing of hard soape with a material called berilia, and without the vse of any fire in the boyling and makeing thereof; and also of makeing of

soft soape without the use of fire in the boyling thereof." The "berilia" consists of ashes of "beanestrawe," "peasestrawe," and of English kelpe. *Queritur*—What is, in this phrase, the meaning of the words "without fire?" does it refer to saponification in the cold? or was steam already used by some for boiling other liquids? Since no specification is enrolled, this question remains unanswered.

This work, to which are added copious indices of subject matter, and of names, will be highly welcomed, both by manufacturers and parties directly interested in patents, and specifications thereof; the work is a valuable addition, also, to the scientific bookshelves and libraries of the day; and the whole manner of execution and abridging of abtruse matters, too often very imperfectly worded, reflects great credit upon the gentlemen to whom the excellent head of the Patent Office has entrusted a task which deserves the praise of all who can understand the difficulty of the proper execution of that task.

Notwithstanding that the book contains nearly 1100 closely-printed pages, it is sold at a very reasonable price, while the paper and typographical execution are also commendable.

MISCELLANEOUS.

Vorläufiges Programm der 43. Versammlung Deutscher Naturforscher und Aerzte, Innsbruck, 1869.—From the printed programme above named, we abstract the following:—The meeting begins on the 18th, and ends on the 24th of September, and will be held at the town of Innsprück, Tyrol. Although this meeting is chiefly an association of German natural philosophers and medical men, foreigners are very welcome, and are admitted as members the same as Germans, on payment of three thalers (nine shillings). Tickets for membership are obtainable by application to Prof. Dr. O. Rembold, Innsprück, on payment of the sum just mentioned; and on the 17th and 18th of September next tickets are to be had at the Hotel de l'Europe, opposite the railway-station of the town of meeting. The following sections are arranged:—Mathematics and Astronomy; Natural Philosophy (Physics) and Mechanics; Chemistry and Pharmacy; Mineralogy, Geology, and Palæontology; Botany and Phytophysiology; Zoology; Anatomy and Physiology; Medicine; Medical Reform; Surgery and Ophthalmology; Gynæcology and Midwifery; Psychiatry; Naturwissenschaftliche Pædagogik (the manner of teaching natural sciences in lower schools); Public Hygiène and Forensic Medicine; Medical Practice of Infants and Young Children; Anthropology and Ethnology; Military Medical Practice. The first general meeting is appointed to take place on Saturday, the 18th of September. Several excursions of interest in the beautiful neighbourhood of Innsprück have been arranged to take place; and most of the German and other Continental railway companies intend granting facilities for the conveyance of visitors to this meeting at greatly reduced tariff.

Explosion caused by Ammonia Gas.—M. Werner.—On the 18th of February last, an explosion took place at the chemical works of Messrs. Kunheim and Co., Berlin. It appears that a large iron vessel of cylindrical shape, 6 feet in diameter, and 4½ feet high, and 13-16ths of an inch in thickness, was used for the evolution of ammonia gas from a somewhat thickish magma; but this operation had been carried on in the same manner for twenty years, and with iron vessels of similar description, which were properly renewed when required. It was this apparatus which exploded; and the author states that the vessel was strong enough to withstand a pressure of 20,000 pounds to the square inch. The apparatus have since been provided with safety-valves; for it appears that the explosion took place immediately after the apparatus had been filled with about 4000 lbs. of ammoniacal liquor, and that the explosion was the joint effect of steam and ammonia gas. The iron apparatus was found to be throughout well made, of good quality and strength, and only a suddenly-applied force would break it.—*Zeitschrift des Vereines Deutscher Ingenieur.*

Testing Acetic Acid.—The value of commercial acetic acid can be estimated by ascertaining how much soda, or carbonate of soda, a given weight can neutralise. Inorganic acids, if present, would also neutralise the alkali; they must be tested for separately, or the determination corroborated, by evaporating the neutralised liquor to dryness, and calcining it at a red heat. All the acetate of soda is then converted into carbonate, the quantity of which may be dosed by the test acid; if it corresponds in quantity with the alkali first required to neutralise the acid, there is no mineral acid present; if it falls short the difference may be ascribed to some mineral acid, the soda-salt of which is not decomposed by red heat. Good commercial acetic acid contains from 18 to 22 per cent of anhydrous acetic acid, and traces only of sulphates and chlorides. When 100 grains of acetic acid neutralise 62 grains of crystallised soda, the acid contains 23 per cent of anhydrous acetic acid. Acetic acid should be tested for lead and copper, for sulphuric, hydrochloric, and nitric acids, should be entirely volatile on being boiled, and, when concentrated, its vapour should readily ignite on being approached by any flame. The strength of vinegar can also only be determined by the same means as indicated for acetic acid. When acetic acid or vinegar are evaporated to dryness on a water-bath, after addition thereto of a few drops of a strong clear solution of loaf-sugar, there should not ensue a deep brownish or black colouration on the residue becoming dry, which would indicate the presence of sulphuric or hydrochloric acids. Vinegar always contains sulphates and chlorides, and, if deeply coloured, also organic matter; the presence of the salts just named is due to the water applied in making the vinegar. Acetic acid should be free from tarry matters and aceton; they will be discovered on gently evaporating, and also on saturation, best with pure carbonate of lime.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, August 23, 1869.

This number contain the following memoirs and communications bearing more especially upon chemistry:—

Researches on the Ethereal Derivatives from Propylic Alcohol.—MM. Pierre and Puchot.—Iodide of propyl, prepared by the reaction of phosphorus upon a mixture of pure propylic alcohol and iodine, exhibits, after repeated purification, a colourless liquid, having a sweetish, somewhat alliaceous odour, boiling at 104·5°; sp. gr., 1·784 at 0°. When this fluid is exposed to air, it is slowly decomposed, and iodine is set free.—Valerianate of propyl, prepared by distilling a mixture of pure propylic alcohol, pure valerianate of potassa, previously dried, and sulphuric acid, very cautiously and gradually added to the mixture, is, after having been purified, a colourless liquid boiling at 157°; sp. gr. at 0°, 0·887.—Butyrate of propyl, $C_8H_7O_2,C_6H_7O$, is obtained by the very cautious distillation of a mixture of previously-dried butyrate of potassa, propylic alcohol, and sulphuric acid. After repeated rectification, a fluid is obtained which boils at 137·25°, is colourless, and exhales the odour of fruit and herb of mint, mixed; sp. gr. at 0°, 0·888.—Acetate of propyl, $C_4H_3O_2,C_6H_7O$, is prepared by distilling a mixture of propylic alcohol, dried acetate of soda, and sulphuric acid. After repeated rectifications, a very limpid, colourless, agreeably-smelling liquid is obtained, boiling at 103°. Sp. gr. at 0°, 0·910.—Formiate of propyl, C_2HO_2,C_6H_7O. After rectification, a liquid is obtained boiling at about 83°. Sp. gr. at 0°, 0·9197.—Propionate of butyl, $C_6H_5O_2,C_8H_9O$, is obtained by distilling a mixture of previously-dried propionate of potassa, butylic alcohol, and sulphuric acid, after repeated distillation and rectification of the raw liquid first obtained. The pure ether is a very fluid, colourless, agreeably-smelling liquid, boiling at 135·7°. Sp. gr. at 0°, 0·8934.—Propionate of ethyl, $C_6H_5O_2,C_4H_5O$, obtained by distilling a mixture of previously-dried propionate of potassa, pure strong alcohol (95 per cent), and sulphuric acid. The purified liquid boils at 100°; its odour is somewhat akin to that of acetic ether. Sp. gr. at 0°, 0·9137.

The Metrical System.—M. J. Dumas.—The report of the committee on this subject, of which this eminent *savant* is the spokesman, reviews the labours of a very select committee of eminent men, representing not only France, but also Switzerland and Holland, who commenced their work in the year 1790, and finished it on the 4th of Messidor, of the year VII. (23rd of June, A.D. 1800). The present committee recommends that the standards of weights and measures in the custody of the Academy shall on no account whatever be altered or tampered with in any way. Since these standards have been made and verified by an international committee of *savants*, and every care was taken to ensure the perfection of these standards, the committee also recommend that the French Government shall give permission to delegates of foreign nations to get copies made of the standards alluded to under proper supervision, and that these delegates do take what care they deem proper to ensure correctness of these copies.

Manufacture of Special Kinds of Pig-Iron.—M. Jordan.—This is a metallurgical memoir, wherein the author discusses the calorific phenomena produced by the injection of jets of air, steam, or oxygen into molten cast-iron. The tendency of this paper, is entirely practical, and it is, moreover, too lengthy for useful abstraction.

Chloride of Acetylen and the Synthesis of Julin's Chloride.—MM. Berthelot and Jungfleisch.—Instead of making chlorine in free state act upon acetylen, the authors have applied chloride of

antimony, by which acetylen is rapidly absorbed, so much so, that, owing to the strong heat which is developed, the mixture has to be cooled. A compound of equal equivalents of perchloride of antimony and of acetylen is obtained, $C_4H_2SbCl_5$. This body is instantaneously decomposed by water; and when gently heated, it is split up into protochloride of acetylen and protochloride of antimony—

$$C_4H_2.SbCl_5 = C_4H_2Cl_2 + SbCl_3.$$

The protochloride of acetylen is a colourless liquid; it smells like chloroform; boils at 55°; moist air slowly decomposes it; heated in sealed tubes to 360°, it is decomposed, carbon deposited, and hydrochloric acid formed. Perchloride of acetylen, $C_4H_2Cl_4$, is also a liquid, boiling at 147°. When this substance is poured into a bottle filled with chlorine gas, it is converted into sesquichloride of carbon, C_4Cl_6; heated to 300° in a sealed tube during fifteen hours, this perchloride is converted into chlorinated protochloride of acetylen and hydrochloric acid—

$$C_4H_2Cl_4 = C_4HCl.Cl_3 + HCl.$$

When the temperature is raised to 360°, and continued for 100 hours, the perchloride of acetylen is converted into the so-called chloride of Julin, which is identical with perchlorinated benzine, and hydrochloric acid—

$$3C_4H_2Cl_4 = C_{12}Cl_6 + 6HCl.$$

Les Mondes, August 12, 1869.

From this number we abstract:—

Electric Light.—The editor learns, with great pleasure, that the directors of the Transatlantic French Steam Navigation Company have entered into a contract for supplying, to their vessels, magneto-electric machines and other requisite apparatus for exhibiting on board during the night-time electric lights as signal-lamps. The superiority of this light is manifest. It need hardly be pointed out that, by adopting this mode of illumination, the directors of the aforesaid Steam Navigation Company greatly increase the safety of their vessels. Electric light ought to be more generally used for this purpose.

New Mode of Gas-Lighting.—M. Boital.—Although no particulars are as yet given, it appears, from a short notice in this paper, that the party just named has established a gaswork, capable of supplying 600 burners on a square surface of no more than 12 square metres. The gas produced is of excellent quality, and the price of making the requisite works, as well as the gas produced, is very low.

This number contains a lengthy paper, illustrated with woodcuts, on the—

Manufacture of Soda-Water-Making Machines and other Machinery.—We only name the title; parties interested will do well to consult the original, which is full of excellent and useful information on this matter.

Journal fur Praktische Chemie, No. 10, 1869.

This number contains the following original essays and papers:—

Experiments on the Salts of the Cerium Bases.—M. H. Zschiesche.—The author of this essay treats, under separate headings:—1st. *Lanthanum Compounds.*—The oxide of lanthanum was obtained by strong and long-continued heating of the oxalate of that base. So obtained, it constitutes a pale red powder, which readily attracts carbonic acid from the air, thereby changing into a bright white-coloured carbonate of lanthanum. The oxide is readily soluble in acids, yielding therewith absolutely colourless salts. Oxalic acid, or better still, oxalate of ammonia, precipitates oxalate of oxide of lanthanum from its neutral or slightly acid solutions, but an addition of ammonia is required for complete precipitation. The oxide of lanthanum is readily soluble in hydrochloric acid, yielding therewith chloride of lanthanum; the neutral chloride crystallises in large non-deliquescent crystals containing five atoms of water. 2nd. *Didymium Compounds.*—The oxide was obtained, as that of lanthanum, by a long-continued and strong ignition of the oxalate; the colour of the oxide so obtained is bright ash-grey. The sulphate of the oxide of didymium is obtained by dissolving the ignited oxalate in sulphuric acid; the excess of that acid is removed by evaporation, the saline mass dissolved in water; and, after concentration of the solution on a water-bath, crystals are obtained exhibiting the colour often exhibited by sulphate of manganese. The author applied this salt to the estimation of the atomic weight of the oxide of didymium, which he found equal to 54·585. Chloride of didymium crystallises with some difficulty, owing to the fact that this salt is very deliquescent; dried over sulphuric acid, the composition of this salt is $DiCl+5HO$. The nitrate of oxide of didymium also crystallises, but the substance is equally deliquescent as the previously-mentioned salt. 3rd. *Compounds of Cerium.*—If we except, says the author, the combinations of oxydulo-oxide of cerium, the compounds of this element have been frequently the subject of researches. When perfectly pure oxalate of cerium is strongly ignited, there ensues a compound corresponding to the formula Ce_2O_4. When this compound is treated with strong sulphuric acid, it evolves a great deal of heat, and forms, when brought into contact with water, a deep orange-coloured solution, which, on evaporation, yields beautiful crystals, in appearance like those of bichromate of potassa; formula—

$$3(CeOSO_3) + Ce_2O_3SO_3 + 18HO.$$

The mother liquor separated from this salt yields a yellow-coloured salt, of which the following formula exhibits the composition:—

$$CeOSO_3 + Ce_2O_3SO_3 + 8HO.$$

The author, after passing a review of several compounds of cerium, treats, at very great length, of various double salts of the cerium bases, but his essay is too lengthy, on the one hand, and too full of formulæ on the other, to yield scope for further useful abstraction.

Action of Hypochlorous Acid upon a Mixture of Iodine and Anhydrous Acetic Acid.—M. Schützenberger.—The substance which is the result of the action just alluded to is, when pure, a solid crystalline body, which, according to the results of analysis, has the formula $I[(C_4H_3O_3)2Cl]$. The author found that this substance, when dissolved in anhydrous acetic acid, acts, at the ordinary temperature, upon metals (copper, for instance), yielding acetic acid and the iodide of the metal; zinc ethyl violently yielding acetate of zinc, acetate of ethyl ether, and iodide of ethyl. The substance does not act upon dry benzol at the ordinary temperature; but if the mixture is heated up to the boiling point of the benzol, the compound of iodine and anhydrous acetic acid dissolves therein, and deposits again from it on cooling.

Quantitative Estimation of Copper by Sulphuretted Hydrogen.—M. E. Ulrici.—The main results of the author's researches may be briefly summarised thus:—1st. When the precipitate occasioned, in solutions of copper, by sulphuretted hydrogen is submitted to strong ignition in an open or covered porcelain crucible, the residue of this ignition is almost always a compound exactly corresponding, by calculation, to the formula Cu_2S. 2nd. This residue is always a mixture of Cu_2S and CuO. 3rd. The result of ignition in a closed porcelain crucible, the lid of which is only now and then removed, will yield a chocolate brown-coloured compound, agreeing with the formula Cu_2S+CuO. The author states that a series of experiments has convinced him that the precipitate obtained by HS from copper solutions may advantageously be applied, after having been well washed, dried, and ignited, for the quantitative estimation of copper. There is added to this paper a lengthy tabulated form, exhibiting results obtained, which certainly indicate that, with due care, this new method of quantitative estimation may often be advantageously applied.

Tyrosin.—M. Barth.—The author states that the results of a series of researches on this subject led him to the conclusion that tyrosin has to be considered as an oxyphenylamidpropionic acid. The author is engaged with experiments to prove this synthetically.

Sulphoxybenzoic Acid.—M. Senhofer.—The author has prepared this acid, and many of its salts, in pure state. Referring to some by-products, among which is protocatechuic acid, the author also discovered some non-crystallisable compounds, which are intermediate between benzoic and paraoxybenzoic acids, on the one hand, and protocatechuic acid on the other. Analogous products are obtained when anhydrous phosphoric acid acts upon eugenol and bitter oil of almonds.

Protocatechuic Acid.—Dr. Malin has prepared this acid from sulpho-anisic acid, and obtained from about 12 to 15 per cent of very pure protocatechuic acid. The author intends to obtain from this acid methyl and ethyl derivatives.

Violet Pigment.—Professor Hlasiwetz.—The author obtains from binitrated naphthol, by means of the reducing action of cyanide of potassium, a beautifully violet-coloured pigment, which has great similarity with indigo. No particulars are given about this discovery, neither about the process by which this substance is obtained. This very brief and imperfect notice is only intended *pour prendre date.*

Iodbenzyl.—M. A. Lieben.—When hydriodic acid acts, at the ordinary temperature, upon chloride of benzyl, iodbenzyl only is formed; this is a solid, crystalline substance, fusing at 24°. Since this body is very ready to undergo double decomposition, it is very suitable for the preparation of benzyl compounds.

Action of Hypochlorous Acid upon Butylen.—M. A. Lieben.—The author says—The chief product of this action is butylen-chlorhydrin; when this is treated with water and an amalgam of sodium, a butylic alcohol is formed, which, on oxidation, yields acetic acid. That alcohol is, therefore, ethyl-methyl-carbinol, and is identical with the alcohol which is obtained from butylen and hydriodic acid and subsequent saponification.

Solubility of Carbonate of Lime in Water Saturated with Carbonic Acid.—M. A. Cossa.—A great many years ago, Professor Bischof, at Bonn, called attention to the fact that the state of aggregation had a great influence upon the solubility of carbonate of lime in water saturated with carbonic acid. The author has studied this subject, and, starting with pure white Carrara marble, has extended his researches over a dozen varieties of carbonates of lime, including chalk, Iceland spar, dolomite, oölithic limestone, and artificially-prepared carbonate of lime. The chief results are as follows:—1000 parts of water, saturated with carbonic acid at the atmospheric pressure (reading of barometer) at the time of the experiment, and at temperatures varying from +7·5° to 28°, dissolve of Carrara marble—at from 7·5° to 9·5°, 1·181 parts; at from 20° to 22°, 0·9487 parts; of Luneberg chalk, 0·835 parts; of artificially-prepared (precipitated) carbonate of lime at 18°, 0·950 parts; of oölithic limestone, 1·252 parts at 15°; of dolomite, from Monticello, 0·573 parts at 15°.

No. 11, 1869.

This number opens with a brief notice of the death of one of its editors, the late Dr. Gustav Werther, Professor of Chemistry at the University of Königsberg, Prussia.—The deceased was born at Rossla, on the Harz, on the 1st of August, 1815, and died on the 29th of June last, at Königsberg. For fully seventeen years the deceased was one of the editors of this periodical.

This number contains the following original papers:—

Researches on Fergusonite.—M. Hermann.—Under the name of fergusonite, such minerals are known as are chiefly made up of an acid of one of the niobium metals and yttria, and belong to the tetragonal system of crystals. These minerals have been found as yet only in Greenland; in Sweden, near Ytterby; in Norway, near Arendal; and a few other localities in these countries. Since Mr. Forbes found alumina and water in two kinds of the fergusonite found near Hampemyr, and since the Greenlandic mineral does not contain these substances, Mr. Forbes believed that these Norwegian fergusonites were peculiar minerals, and named them tyrite and bragite. The author of this paper states that other chemists did not find any alumina in these fergusonites, while the quantity of water was found to vary between 1 and 6·44 per cent. As regards the substances designated as niobic acid, several quite different compounds are named; for instance, the niobic acid of the Columbites is (TaO_2,NbO_2,IlO_2); the niobic acid of Æschynite is (NbO_2,IlO_2); the niobic acid of Samarkite consists of (IlO_2,TaO_2,TiO_2), and, moreover, of a peculiar metallic acid as yet but imperfectly known. The author has tried to elucidate these matters, and has analysed a sample of very pure fergusonite from Hampemyr; the sample selected weighed 360 grains, and was imbedded in granite. After having been separated from its matrix, this mineral exhibited a glassy lustre; colour, brownish black; in powder, cinnamon-brown; hardness, 6; sp. gr., 5·31. When heated in a small flask, the mineral decrepitates and gives off water. After having lost its water, the mineral could not be fused when held between platinum-pointed forceps in the flame of a spirit-lamp. On being thus heated, the colour of the mineral changes to yellow; heated before the blowpipe-flame with borax, the reaction of uranium is exhibited; loss on ignition, 3·75 per cent of water. The not-previously-ignited mineral is readily fused and disintegrated with bisulphate of potassa. The metallic acid of the fergusonite from Hampemyr consists, according to this author's researches of two atoms of niobous-niobic acid and one atom of ilmenous-ilmenic acid. In 100 parts, this mineral consists of:—Stannic acid, 0·06; niobous-niobic acid, 29·56; ilmenous-ilmenic acid, 13·82; titanic acid, 0·67; zirconia, 4·02; thoria, 3·44; oxide of cerium, 0·77; yttria, 37·15; protoxide of uranium, 3·43; protoxide of iron, 1·43; lime, 1·90; water, 3·75; and traces of protoxide of manganese and oxide of lead. The author, in this very extensive and exhaustive essay, quotes a large number of analyses of various species of this mineral, but space forbids to enter into more details on this subject.

Researches on the Composition of Samarkite, and Observations on the Chemical Constitution of the Niobium Metals.—M. R. Hermann.—The author states that, though there are a large number of analyses of samarkite in existence, these analyses are, in this aspect, imperfect; that, at the time they were made, the more delicate methods for estimating small quantities of tantalic, niobic, and ilmenic acids were unknown. The author then reviews, at length, the labours of various chemists and mineralogists on this subject; and next enters, at great length, into very minute details of methods of analysis. The chief result of his researches, as regards samarkite, gives, for that mineral, the following percentage composition:—Stannic acid, 0·35; titanic acid, 4·94; tantalic acid, 3·40; ilmenous-ilmenic acid, 24·57; a peculiar acid, 26·61; thoria, 4·47; yttria, 14·60; protoxide of uranium, 10·58; protoxide of iron, 10·70; magnesia, 0·34. The author next enters into lengthy particulars about some minerals which are homo-morphic and poly-morphic with samarkite. The paper ends with an essay on the constitution of the niobium metals.

Water of the Hydrosilicates.—Dr. F. von Kobell.—The author begins with some observations on water of crystallisation and so-called basic water. He next calls attention to the fact that the silico-hydrates of magnesia, and some minerals, as, for instance, prehnite, euklase, and others, contain water, which is only expelled by long-continued and strong ignition. Dr. Rammelsberg has suggested that this so-called basic water is not contained in the minerals as water, but exists therein as hydrogen and oxygen, and is only formed, combined, when the ignition takes place; but the author thinks that this opinion does not explain sufficiently the reason why the water of the hydrosilicates should be expelled so difficultly and unequally by heat. Since the oxides of different metals behave differently when submitted to heat in respect of giving off part or whole of their oxygen, the author of this memoir thinks that a somewhat similar cause may operate in respect of the more or less readiness wherewith minerals part with their so-called basic water. In this, however, should be taken into account the time the heat acts, and the degree to which it is applied. In this latter respect, the author has made some experiments with a few minerals, submitting them, first in lumps, next in powder, and in weighed quantities, repeatedly for a known time to the same degree of heat. A piece of analcime weighing 4·74 grms. did not lose all its water after four ignitions, while the same weight of the same powdered mineral lost its water entirely after three ignitions, all of the same duration of time.

On Aspidolite.—M. von Kobell.—This mineral—the hardness of which is about 2; sp. gr. 2·72—consists, in 100 parts, of:—Silica, 46·44; alumina, 10·50; magnesia, 26·30; protoxide of iron, 9·0; soda, 4·77; potash, 2·52; water, 1·13.

Paragonite from Virgenthal, Tyrol.—M. von Kobell.—There occurs, at Virgenthal, a greenish-coloured mineral, which has great likeness to nephrite, and is applied for ornamental purposes, after having been cut and polished. The sp. gr. of this mineral is 2·9. In 100 parts, it consists of:—Silica, 48·00; alumina, 38·29; peroxide of iron, 0·91; soda, 6·70; potassa, 1·89; magnesia, 0·36; water, 2·51.

On Atractylic Acid.—M. Lefranc.—This acid occurs in the root of the *Atractylis gummifera* in the shape of atractylate of potassa, which may be obtained from the root by exhausting it with boiling water, evaporating this solution, and taking up the residue with alcohol of 85 per cent, purifying with animal charcoal, and and re-crystallisation from alcohol. The atractylic acid is obtained in free state by decomposing the potassa salt with acetate of lead, and by next decomposing the atractylate of lead thus formed with dilute sulphuric acid. The atractylic acid so obtained is a colourless fluid, having a sour, but, at the same time astringent, bitterish-sweet taste; reddens blue litmus-paper; is not precipitated by chloride of barium; cannot be obtained in concentrated form; and is decomposed on being boiled and converted into sulphuric and valerianic acids, sugar, and resin. Formula, S_4O_{12},$C_{60}H_{32}O_{20}$.

Naphthalin and Anthracen (Paranaphthalin).—Dr. Vohl.—The author calls attention to the naphthalin and anthracen manufactured by Messrs. Gerhartz and Co., at Cologne. These gentlemen have succeeded, by means of an improved method of manufacture, in obtaining the two substances just named in perfectly pure state, and in solid bars or discs, akin to those of white wax. The author has tested these substances, and found them to be quite free from creosote and oily matters. The same firm also manufactures nitro-derivatives of these substances in pure state.

On Hartite.—M. Rumpf.—By this name is understood a peculiar hydrocarbon (C_8H_5), found some years ago near Gloggnitz, among the coal of the Oberhart district. The author obtained a sample of this rather rare mineral from Voitsberg and Köflach, in Styria, and found that, crystallographically, this mineral belongs to the *triklinic system*. The elementary organic analysis of this specimen led to results giving the same formula as above stated. This mineral appears to occur among lignitic brown coal, and is evidently formed during the peculiar eremacausis the wood is subjected to.

Cresylo-Purpuric Acid.—Dr. von Sommaruga.—The author obtained this acid, $C_8H_7N_5O_6$, by a process which is not described in the brief notice given on this subject. The author states that, while studying the products of decomposition of trinitrocresylic acid and cyanide of potassium, he discovered, besides cresylo-purpuric acid, a peculiar compound, which, after having been purified, appears to exhibit great analogy with indigo in many respects. M. Hlasiwetz has obtained a somewhat similar compound from dinitronaphtol. Both authors are engaged in further researches on this subject.

Aminamides of the Fatty Acid Series.—Dr. Linnemann.—The author has particularly studied the behaviour of formamides—for instance, ethylformamide, prepared by him by means of a simple process, towards such substances as withdraw water from these bodies (*Wasserentziehende Mittel*). He found that carbylamines are not formed, as stated by Messrs. Chapman and Smith, but that carbonic oxide, carburetted hydrogen, and ammonia make their appearance. Ethyl-acetamide behaves in the same manner under the same conditions; but diacetamide, obtained by a peculiar process, not described in this notice, is decomposed into aceto-nitrile and acetic acid when acted upon by materials which are capable of withdrawing water from these bodies.

Neues Jahrbuch für Pharmacie, von Dr. F. Vorwerk, May and June 1869.

These two numbers have been published together, stitched in one cover.

We abstract from this the following original matter:—

Contribution to the History of Buxine.—M. Flückiger.—The author begins this paper with an historical introduction, going back as far as the year 1636. Next he discusses at great length the pharmacognostical differences of *Radix Pareiræ bravæ*, *Cissampelos Pareira*, *Botryopsis platyphylla*, and thereupon alludes to pelosine, an alkaloid discovered in 1838, by Dr. Wiggers, in the Pareira. This alkaloid the author assumes to be identical with bibirine. This latter alkaloid is stated to be identical with buxine, a substance discovered, in 1860, by Walz, in the leaves of the *Buxus sempervirens* (box-tree). Buxine, according to this author, is an alkaloid identical with those already named, and a substance not simply met with in the leaves and bark of the box-tree, but far more generally dispersed through the vegetable kingdom, and especially met with in the natural families of the Euphorbiaceæ, Laurineæ, Rubiaceæ, and others. Buxine is very difficultly obtained in a pure state, since it is naturally accompanied by a peculiar substance called buxoflavine. Buxine is characterised by the property that its concentrated solution in hydrochloric acid is precipitated by nitrate of potassa, chloride of ammonium, and iodide of potassium, which latter salt precipitates even the dilute solutions of buxine copiously.

The Colouring Matter met with in the Common Buckthorn Bark.—M. Faust.—After reviewing the labours of Messrs. Ferber, Binswanger, Buchner, Casselmann, and others, on this subject, the author states that frangulin is the chief active principle of the bark in question. Frangulin is a glucoside; its formula is $C_{20}H_{20}O_{10}$, it fuses at 226°; is soluble in alkalies, exhibiting a beautifully purple coloured solution. When the alcoholic solution of frangulin is boiled with one-third of its bulk of hydrochloric acid, this material is split up into sugar and frangulinic acid, $C_{14}H_{10}O_5$. This acid crystallises, exhibiting yellow-coloured crystals; readily soluble in alcohol and ether, but very difficultly so in water; also readily soluble in dilute aqueous solutions of alkalies, and in ammonia exhibiting a magnificent red colour. The acid fuses at about 249°. Acids precipitate from the alkaline solutions of frangulinic acid the latter acid in unaltered state.

Researches on Hydroborocalcite [illegible] author says about twenty-five years have elap[illegible]ed, near Ibique, in S[illegible]

his researches, consisted, in 100 parts, of:—Lime, 18·89; boracic acid, 46·11; water, 35·00. Since the time this analysis was made, the mineral locally known as teza has become an article of commerce, and is brought over to Europe with the view of being applied to the manufacture of boracic acid and borax. According to the author, this mineral, which is chiefly found in nodules among the nitrate of soda beds of Peru, when dried at 100°, has, in 100 parts, the following composition:—Borate of lime, 52·39; borate of soda, 10·23; sulphate of soda, 1·06; chloride of sodium, 3·76; residue insoluble in acid, 4·23; water, 28·33.

The Manufacture of Borax from the Native Borate of Lime.—Dr. Graeger.—The author states that, since he found that what is stated in treatises and handbooks on chemistry concerning pure borate of lime is generally quite erroneous, he commenced by studying the properties of that substance more minutely. Pure borate of lime is only slightly soluble in pure water, 100 parts of which, at about 18°, only dissolve from 0·304 to 0·333 parts of that salt; boiling water does not dissolve, perceptibly, more of this salt. A solution of pure borate of lime in water behaves, with the following reagents, in the following manner:—Ammonia, no precipitate; caustic potassa solution, very slight precipitate, due to a trace of carbonate present along with the caustic alkali; carbonate of ammonia, copious precipitate, soluble in excess of precipitant; carbonates of potassa and soda, permanent precipitates; neither the nitrate of protoxide, nor of peroxide of mercury, nor, also, neutral chloride of iron, exhibit any reaction with the solution in question; solution of sulphate of copper gives a greenish blue precipitate. Since borate of lime is less soluble, even in alcohol, than sulphate of lime, a solution of the former salt in water containing only 1000th part of the salt is readily precipitated by alcohol containing 60 per cent of absolute alcohol. The presence in solution in water of some salts, especially chloride of sodium and ammonium, largely increase the solubility of borate of lime in water. Such acids as form with lime readily soluble salts, do readily dissolve borate of lime, both pure and native; and from such solutions, if concentrated, boracic acid is precipitated. The portion of this paper relating to the manufacture of borax and boracic acid from the native borate of lime alluded to, is rather a practical receipt for the proper performance of this branch of industry, and, therefore, not well suited for abstraction, the less so as the price of fuel, soda, and other things necessarily influence the applicability of the borate of lime for that purpose.

Glycerine as a Substitute for Spirits of Wine for the Preservation of Zoological and Anatomical Preparations.—Dr. Koller.—The author recommends concentrated glycerine as being cheaper, not liable to evaporation, not combustible, and, moreover, as better preserving the natural colour of various preparations usually kept and preserved in spirits of wine. According to the author, glycerine answers this purpose eminently.

New Method of Fusing Difficultly Decomposable Minerals.—Dr. Vorwerk recommends that 1 part of the previously very finely-powdered mineral should be mixed with 3 parts of fluoride of sodium, and that this mixture, after having been placed in a platinum crucible, should be covered with 12 parts of powdered bisulphate of potassa. Minerals such as chrome iron ore, hard hæmatite, tin ores, and rutile, corundum, and the like, are very readily brought to fusion and disintegrated by this flux, even with no more heat than that obtained from a good Bunsen gas-burner.

Sindor Oil and Sindor Balsam.—M. Maier.—These substances are used externally, in some diseases of the skin, by the Javanese. The real sindor tree belongs to Borneo, and is called there pohon-sinampar. The balsam investigated by the author has the consistency of balsam copaivæ, and exhibits a smell not unlike the latter substance; sp. gr. at 27·5°, 0·9221. The sindor balsam boils at 255°; burns, when heated to a higher temperature, with a flame emitting much soot and smoke; on being distilled along with water, the balsam left a reddish brown-coloured transparent resin. The balsam is difficultly soluble in alcohol, and on being brought into contact with strong sulphuric acid, became blood-red coloured. The essential oil, obtained by distilling the balsam with water, was of a light yellow colour, very fluid, boils at between 245° and 250°; sp. gr. at 27°, 0·914; soluble in from 4 to 5 parts of cold, and from 1 to 1½ parts of hot alcohol. The author extended his researches to other balsams, which, though bearing the same name, are evidently either obtained from different trees, or have undergone peculiar preparations whereby their physical and chemical properties are very much altered. As to the trees yielding these balsams, the eminent botanist, M. Teysmann, who has resided for upwards of forty years in Java, states that they are not precisely known.

Distinction between Gum Arabic and Gum Senaar.—M. Schlosser.—According to the author, these two kinds of gum are not, as generally supposed, different only in quality from each other, but the senaar gum is undoubtedly derived from another tree. The behaviour of these two kinds of gum with acetate of lead is, according to the author, a ready means of distinguishing between the two with certainty; take 3 grms. of pure gum arabic, dissolve in 15 grms. of water, add gradually, and whilst stirring the mixture, 30 grms. of acetate of lead (from the wording in the original, it is impossible to infer whether an aqueous solution is meant or the dry salt in powder) there thus ensues a whitish precipitate, forming a rather thickish magma, which is transferred to a filter, the filtrate, about 18 to 20 grms., running off, exhibiting a hardly even opalescent fluid; the filtration is finished in an hour's time, and the residue left on the filter is no more fluid; take about 6 grms. of the filtrate, add 5 grms. of pure water and 1½ grms. of liquid ammonia, specific gravity 0·960, the fluid will remain quite clear, and even if, after twelve hours' time, a sediment were deposited, this does not amount to more than ½ c.c. When gum senaar is treated in the same way it yields a milky filtrate; the filtration is extremely slow, and even after twenty-four hours the substance on the filter appears fluid. When 6 grms. of this filtrate are treated precisely as just described, the contents of the test tube, on being shaken about, become solidified, exhibiting a gelatinous mass.

A New Preservative Against Fire.—M. Reinsch.—The author states that, having been requested to report to a fire insurance company about the best means of preventing timber bursting into flame, he experimented with various salts, and at last came to the conclusion, as the result of his experiments, that impregnating timber with a concentrated solution of rock salt is as good, if not better, a preservative against its bursting into flame as water glass (silicate of soda), while the price of the former salt is, of course, only a mere trifle; moreover, rock salt thus applied to timber is a preservative against dry rot and noxious insects. The author recommends the use of salt water, that is to say, a solution of rock salt of moderate strength for the use of fire engines during a fire as by far more effective than water; but in order that the salt should not injure the working parts of the engines, they will immediately afterwards have to be played with fresh water again.

Cosmos, August 28, 1869.

This number contains, amongst its very varied information, the following:—

What becomes of Old Shoes.—They are cut up in small pieces, and these are put for a couple of days in chloride of sulphur, the effect of which is to make the leather very hard and brittle. When this is found to have been effected, the material is withdrawn from the action of the chloride of sulphur, washed with water, dried, ground to powder, and mixed with some substance which causes it to adhere together, for instance, shellac or any other resinous material, or also good glue or thick solution of gum; it is then pressed into moulds and shaped into combs, buttons, knifehafts, &c.

The Poisoned Fountain.—In La Limagne, Département Puy de Dôme, France, carbonic acid is nearly everywhere given off in smaller or larger quantity from the limestone formation which occurs there. Near Aigueperse, a town in the Département just named, a locality exists which is popularly named the "poisoned fountain;" it consists of a round hole placed in a depression of the soil, and this hole contains somewhat turbid water, from which carbonic acid constantly escapes, accompanied by a noise as if steam were blowing off from the safety valve of a steam boiler. It often happens that birds and other animals which come near this hole to drink from the water it contains, are asphyxiated at once by the carbonic acid. Such sources are often found in volcanic districts; near Naples the well-known "Grotto del cane" occurs, and the "Death valley" in the island of Java is the most extensive instance of this kind known.

NOTES AND QUERIES.

Aniline Colours.—Can any of your correspondents kindly favour me with the best and cheapest method of dissolving aniline colours suitable for calico-printers?—Alexis.

Tungstate of Soda.—Can you tell me if tungstate of soda is a conductor or non-conductor of heat, and where I can get it, and price? I want it to make paper fireproof, or can you tell me of anything else that will make paper fireproof, and at the same time a non-conductor of heat, and cheap?—Alfred Burn.

Printing Scarlet.—Can any of your courteous readers inform me of a substance that will prevent a solution of bichloride of mercury from being decomposed when boiled in a copper kettle, but afterwards permit it to be precipitated as a scarlet biniodide by a solution of iodide of potassium? I wish to print it upon cotton-cloth, using the same *modus operandi* as calico printing. I find that the copper colour-kettles and printing-rollers decompose it, in consequence of the mercury uniting with the copper. The effect is not satisfactory if I use the solution of iodide of potassium as a mordant. How can I prevent the chloride solution from being decomposed?—Willian.

TO CORRESPONDENTS.

*** The Students' Number of the Chemical News will be published on Friday, September 17th. Gentlemen holding official positions in the Universities, Medical Schools, &c., of the United Kingdom, where Chemistry and Physical Science form a part of the Education, who have not yet forwarded the necessary information to our office for publication in that number, will confer a favour by sending it with the least possible delay.

BOOKS RECEIVED.

Recent Discussions on the Abolition of Patents for Inventions in the United Kingdom, France, Germany, and the Netherlands. London: Longmans, Green, and Co.

Chemical Manufacturers' Plant. By Robert Daglish and Co. Lancashire: St. Helen's Foundry.

On Fresh Meat Preservation. By John Gamgee. London: Robert Hardwicke.

THE CHEMICAL NEWS.

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ON THE

DETECTION OF FIXED OILS IN PLANTS.*

By T. T. P. BRUCE WARREN.

THE object of this communication was to point out a simple method applicable, on a small scale, to the determination of oils in vegetable juices, &c.

To juice containing caoutchouc, hydrochloric acid is first added, to coagulate it. The residue is treated with bisulphide of carbon, which dissolves out the oily and fatty matter. The addition of dichloride of sulphur causes a granular precipitation in the clear decanted solution.

Fibrous substances are preferably treated with rectified ether, and the caoutchouc, if present, removed by the addition of alcohol, before digesting in bisulphide of carbon.

ON THE

PRESENCE OF SOLUBLE PHOSPHATES IN SEEDS.†

By F. CRACE CALVERT, Ph.D., F.R.S.

SOLUBLE PHOSPHATES IN COTTON PODS.

SOME results which I had obtained on the presence of the acid phosphate of magnesia in cotton-fibre, and which I had the honour to lay before the Chemical Society some time since, induced me to continue these researches with a view of ascertaining if the same phosphate existed in the other portions of the cotton pod, viz., the husk and the seed, and, if not, whether the phosphoric acid existing in the same was combined with other bases. It will be, no doubt, also remembered that I found that the mean quantity of acid phosphate of magnesia, $2MgO,HO,PO_5$, in ten samples of cotton fibre which had been imported from various parts of the globe, was equal to 0·05 per cent PO_5, or 0·084 $2MgO,HO,PO_5$.

But, before examining the nature and amount of phosphates present in the husk and seeds constituting the cotton pod, I deemed it advisable to repeat my former experiments, and to confirm them by separating the cotton fibre from the same pods from which I intended to submit the husks and seeds to analysis, and I am glad to say that I obtained results confirming entirely the previous ones, viz., that 100 parts of cotton fibre yielded, when repeatedly washed with water, a quantity of acid phosphate of magnesia = 0·084 of acid phosphate of magnesia, or 0·050 of phosphoric acid, and, further, as in my previous results, only a trace of potash and lime were found in solution, and that no other salts of magnesia existed in solution.

HUSKS.

To ascertain if the amount and nature of the phosphates in the husks of the cotton pods were the same as in the fibre, 14·45 grms. of husks were reduced to fine powder, and steeped for twelve hours with 250 grms. of distilled water. This operation was repeated four times each, and the whole of the washings were filtered off, evaporated to dryness, and the residue calcined, and the following results were obtained on the analysis of the ash:—Only a small quantity of magnesia and lime was detected, nearly the whole of the phosphoric acid being combined with potash and with oxide of iron. The following results being obtained—

One hundred parts of husk gave—

Phosphate of potash, 0·531 = 0·178 PO_5, combined with potash.
Phosphate of iron, 0·227 = 0·106 PO_5, combined with sesquioxide of iron.
Phosphate of lime, 0·030 = 0·016 only PO_5, combined with lime.
And a trace of magnesia.

Therefore the phosphoric acid in the husk is not combined with magnesia, as in the fibre, but with potash and oxide of iron, and the total amount of phosphoric acid, instead of being 0·050, as in the cotton fibre, is 0·300, or six times as large.

SEED.

I now proceeded to determine the composition and amount of phosphates in this portion of the cotton pod, and obtained the following results:—

0·650 of phosphate of potash = PO_5, 0·217
0·117 of phosphate of magnesia = PO_5, 0·069
0·025 of phosphate of iron .. = PO_5, 0·011

These results, which are the mean of two analyses, as in the previous cases, show that the phosphates exist in much larger quantity in the seed than in the other parts of the pod—being, in fact, about sixteen times as large as in the fibre, and between three and four times that found in the husk.

Thus the quantity of phosphoric acid and phosphate existing in the various parts of the cotton pod are—

	PO_5
Husk	0·300
Fibre	0·050
Seeds	1·092

The above results reveal two important facts—viz., that phosphates of potash, magnesia, and iron predominate in seeds, and not the phosphate of lime, as it was generally admitted; also that the nature and amount of the phosphates vary with each part of the said pod.

Further, it will be observed, that, in the husk, the phosphates of iron and potash predominate; in the fibre, phosphate of magnesia; and in the seed, phosphates of potash and magnesia. And what increases the interest is that nearly the whole of the bases existing in the cotton pod are combined with phosphoric acid.

THE AMOUNT OF SOLUBLE AND INSOLUBLE PHOSPHATES IN WHEAT SEED.

English White Soft Wheat.—220·8 grms. of very carefully picked and cleaned white wheat, dried at 230° F., were repeatedly washed with distilled water, and the washings evaporated, and the residue calcined, when only—

0·010 of residue was left, thus showing that water had little or no action upon the grain when acted upon in such a condition.

I therefore decided to act on the same grain when crushed, so that water could penetrate into the mass, and dissolve all soluble salts; but, before doing so, I deemed it advisable to determine the total amount of phosphoric acid existing in the wheat operated upon, and obtained, in one analysis, 0·633 per cent of phosphoric acid, and, in a second analysis, 0·677 per cent, or 55·5 on 100 parts of ash.

These results clearly show, as Fresenius has done before me, that nearly the total of the ashes left by wheat is represented by phosphates.

With a view of ascertaining what amount of these phosphates would be dissolved by water in crushed wheat, 50 grms. of white, crushed soft wheat, dried at 230° F., were placed in a bottle with 150 grms. of distilled water, mixed with a little carbolic acid, so as to prevent any fermentation, or the production of any acid. After twenty-four hours, the aqueous solution was removed, and a fresh quantity of distilled water added; and these washings were repeated until all mineral matter was dissolved, the whole of the washin[illegible] and the residue calcined. The ash[illegible]id determined

* Abstract of a paper read before the British Association, Exeter meeting, Section A.

† Read before the British Association, Exeter meeting, Section B.

was equal to 0·394; therefore nearly two-thirds of the phosphoric acid or phosphates existing in wheat are soluble in water.

English Red or Hard Wheat.—I deemed it advisable to determine the total amount of phosphates and of soluble phosphates in red or hard wheat, as I had done in soft or white wheat, and thus found that 100 parts of red hard wheat, dried at 230° F., yielded 0·749 phosphoric acid; and that 100 parts of the same, when dried at 230° F., and crushed, yielded 0·376 of soluble phosphates.

I regret that I had not the opportunity of repeating these results on white and hard wheats obtained from various countries, or cultivated on different classes of soils, viz., clay, lime, or sand formations, as the phosphates are in larger proportion in red wheat than in soft, and that half the phosphates are soluble in the red wheat and two-thirds in the white soft wheat, and therefore I cannot, under these circumstances, assume that the difference in amount of the phosphates is due to the nature of the wheat, and not to the soil.

These results led me to enquire if the various parts which constitute the grain of wheat contain the same amount and nature of phosphates when separated by the successive and different operations carried out by a miller.

The results of my experiments, as it will be seen, have fully answered my expectations—viz., the phosphates in each section of the cortical parts of the grain do not so much vary in their nature as they do in quantity: their amount decreases gradually from the outer sections towards the central ones; thus, whilst the flour contains only a trace of phosphates, especially soluble ones, the bran contains a large quantity.

The total amount of phosphoric acid in—

Bran	1·682
Flour	0·971

Soluble phosphates—

Bran	1·264
Flour	0·080

A large miller in the neighbourhood of this city having kindly consented to grind and bolt a few sacks of wheat, to enable me to obtain in a separated state the various parts constituting the grain, and placed in my hands the five distinct specimens, as representing in a rough way those various layers presented by a grain of wheat.

No. 1. Coarse bran.
No. 2. Coarse bran.
No. 3. Coarse sharps.
No. 4. Fine sharps.
No. 5. Flour.

AMOUNT OF PHOSPHORIC ACID AND PHOSPHATES IN THE VARIOUS PARTS OF WHEAT.

	Corn and bran.	II.	III.	IV.	Flour.
Phosphoric acid combined with sesquioxide of iron	0·042	0·047	0·037	0·015	0·022
Phosphoric acid combined with magnesia and a small quantity of CaO	1·485	1·259	0·657	0·329	0·047 0·144
Phosphoric acid combined with potash	1·071	1·046	0·459	0·280	0·758
Total—	2·598	2·352	1·153	0·624	0·971
Phosphate soluble in water	1·942	1·666	0·918	0·529	0·080

These facts also tend to show that most of the phosphates contained in wheat are not combined with the organic matter, but are in a free condition.

Further, that the greatest part of the phosphates are soluble, and combined with potash and magnesia, whilst the insoluble phosphates are represented by lime, iron, with a small proportion of MgO, the latter salt being probably neutral phosphate of magnesia, $3MgO,PO_5$, whilst the salt of MgO in solution is $2MgO,HO,PO_5$; and what tends to support this view is that, although the same weights of bran were washed with the same quantities of water, and for the same space of time, the quantities of phosphates of magnesia decrease rapidly in each successive layer of the seed as we proceed from its external part towards its interior.

Also that, whilst in No. 1 bran only one-fifth of the phosphates are retained as insoluble, in No. 4 one-sixth remains in an insoluble condition.

These analyses clearly illustrate that, although habit and pride have gradually led us to prefer white bread to brown, or more so bread made with nearly the whole of the constituents of wheat grain, still this practice is an error when we consider the nutritious properties of wheat, especially as a food for children, when phosphates are so essential to the formation of bone and blood; and medical men would confer a great boon on society if they were to impress the importance of feeding children with a wheaten preparation in which all the constituents of the grain were preserved.

These views are further supported by some very interesting researches published in the *Comptes Rendus* by M. Mège Morries, in which he proved that there was, in the inner cortical parts of the wheat, a special ferment, which converted most rapidly starch into sugar, and thereby facilitated the conversion of wheaten flour into bread.

These observations of M. Morries led him to devise a peculiar mode of grinding wheat, and making bread from the flour thus obtained, and the results were such that, from every hundredweight of wheat, he was enabled to obtain of bread—

Wheat, 100.

Ordinary process ..	70 flour ..	92 bread
M. Morries	82 „ ..	110 „

This method was so satisfactorily carried out that the Emperor of the French adopted it at the military bakery of Paris, in which bread is baked every day for 100,000 men.

In conclusion, I may be permitted to state that I am aware of the analyses of wheat which have been made by Professor Way and Dr. Voelcker, and especially of those remarkable and extensive researches published by G. B. Lawes, F.R.S., and G. H. Gilbert, F.R.S., "On the Composition of the Ash of Wheat Grain," and, by the last-named gentleman, "On Wheat Grain and its Product in the Mill." But the researches of these gentlemen only give the total amount of phosphoric acid in these products, but do not give, as I have attempted to do, the respective various proportions of phosphates of potash, magnesia, lime, and iron which exist in the various parts of wheat grain.

ON THE PHOSPHORESCENCE OF THE SEA, AND ON OZONE IN CONNECTION WITH ATMOSPHERIC CONDITIONS.*

By J. MOFFAT, M.D., F.R.A.S., F.G.S., &c.

As it appears from results deduced from observations taken at sea, that ozone periods (as on land) commence, and that ozone is in maximum quantity with decreasing readings of the barometer and the conditions of the south or equatorial current of the atmosphere, and that ozone periods terminate with increasing readings of the barometer and the setting in of the polar current, and that phosphorus is luminous and non-luminous under similar conditions, I supposed that there might be some con-

* Read before the British Association, Exeter Meeting, Section B.

nection between ozone and the phosphorescence of the sea.

Observations are still taken, and I hope to be able to give results from a larger area. The following are deduced from observations taken between latitudes 58° and 79° N., and longitudes 6° E. and 67° W.:—

TABLE I.

Shewing the Amount of Ozone with (at Sea)—

BAROMETER.		DIRECTIONS OF THE WIND.				PHOSPHORESCENCE.	
Increasing.	Decreasing.	N. to E.	S.E.	S. to W.	N.W.	None.	Brilliant.
2·9	4·7	1·6	2·7	3·7	3·2	2·4	3·0

TABLE II.

Shewing the Mean Reading of the Barometer, Mean Temperature, and Daily Mean of Ozone at the Commencement and Termination of Phosphorescence of the Sea, between latitudes 58° and 79° N., and longitudes 6° E. and 67° W.

Phosphorescence.	Barometer.	Thermometer.	Ozone.
Commencement of	29·46 ..	34·8 ..	2·9
Termination of	29·65 ..	30·0 ..	1·5

TABLE III.

Shewing Mean of the Barometer and Thermometer, and the Daily Mean of Ozone, with Commencement and Termination of Periods of Luminosity of Phosphorus, deduced from the Observations of Six Years (on Land).

Periods of Luminosity of Phosphorus.	Mean of Barometer.	Mean of Thermometer.	Mean of Ozone.
Commencement	29·640 ..	47·3 ..	5·0
Termination	29·734 ..	43·4 ..	3·0

By these results, it appears that the phosphorescence of the sea and luminosity of phosphorus occur under similar atmospheric conditions.

The amount of ozone the day before phosphorescence 0·8
" " day of " 2·5
" " day after " 1·9

Of auroral displays, one was without ozone, and 50 per cent were accompanied by phosphorescence.

A FEW REMARKS ON THE

REDUCED OR PRECIPITATED PHOSPHATE OCCURRING IN SUPERPHOSPHATES.

By ALFRED SIBSON, F.C.S.

THE fact of superphosphate "going back," or losing in soluble phosphate, on keeping, will hardly at present be disputed, the question at issue being whether the phosphate so reduced can be estimated or not.

It often happens that a quantity of superphosphate, which, when freshly made, contains, say, 25 per cent of soluble phosphate, is found, after keeping (in some cases only a short time), to have lost 2, 3, 5, or even more, per cent of its soluble phosphate; in fact, the paper of Mr. Sutton, which appeared two or three week's since, and which, although averse to the above question, the superphosphate operated on is stated to have contained, originally, 23 per cent, while it then had only 17 to 18 per cent, or a loss of 5½ per cent. Instances of this kind are, however, familiar to all who have had much to do with this class of manures.

As it is, also, found impossible by the manufacturer to calculate upon the extent of this retrogression, it is a constant source of dispute between buyer and seller, and also tends to bring discredit on analysis, as there is no apparent reason why a superphosphate should contain less soluble phosphate at one time than it did at an earlier period; in fact, the contrary would naturally be expected from the concentration of the bulk through the loss of moisture.

There thus appears an urgent necessity for some means of determining the phosphate so reduced; and if a scientifically-accurate method be not forthcoming, it appears to me only reasonable to be satisfied, under the circumstances, with some method which, for all practical purposes, gives comparative and reliable results; such a method I have found to be the following:—

The point is to find some reagent which does not affect the undecomposed coprolite (that being the mineral now more especially considered). I soon found that dilute acids, including acetic, citric, and oxalic (this least so), were objectionable on this account, and was led to try oxalate of ammonia, which, as a perfectly neutral salt, would be altogether unlikely to decompose a perfectly mineralised substance like coprolite. As well known, the decomposition of gelatinous phosphate of lime by oxalate of ammonia is a quantitative reaction, which takes place at once, the only necessity for boiling being to assist the subsequent filtration. Boiling for ten minutes at the most is sufficient to effect this object, while the oxalate does not, under these circumstances, attack the coprolite to any material extent. I am aware this statement is somewhat at variance with the results of other contributors which have lately appeared, but, as the process they state differs from that I have adopted, the different results may, perhaps, be accounted for. I have no intention, however, of entering into a controversy on this subject, but give the full particulars of the process, so that any one interested in the matter can try it for himself. I have since found that oxalate of ammonia had been suggested by others for this purpose, but was unaware of the fact when I selected it.

25 grains of Cambridge coprolite are boiled, with an equal weight of oxalate of ammonia, in 2 ounces of water, for ten minutes, and filtered; the filtrate acidified with hydrochloric acid, and made alkaline with ammonia (merely to ensure the presence of chloride of ammonium); and ammoniacal sulphate of magnesia added. No precipitate will probably be obtained; but, *if it be obtained*, it is not conclusive of the presence of phosphoric acid; and great errors may be made if a precipitate in this place be accepted as phosphate of magnesia and ammonia. After standing for two hours, the small precipitate is collected (which often resembles the phosphate closely, but consists of oxalate of magnesia, which sometimes separates from a concentrated solution, and a little oxide of iron) and re-dissolved in hydrochloric acid, citric acid added, and re-precipitated with ammonia. A precipitate, if now obtained, consists of phosphate of magnesia and ammonia only, and if burned and weighed as phosphate of magnesia in the usual way, will be found to amount to less than 0·50 per cent, calculated as bone-earth. This was found to be the case with coprolite ground as fine as it is possible to get it for analysis; but I have just been through the process again with coprolite in the state usually employed by manufacturers, and find no weighable quantity of phosphate of magnesia after standing three hours. I thus consider that 0·50 per cent of phosphate of lime is the utmost error that can be made by this process under proper management.

In the case of a superphosphate containing reduced phosphate, and treated as above, after having first extracted the soluble phosphate, by cold water, the phosphate of magnesia calculated as bone-earth will represent the phosphate so reduced.

I am aware of the new process, suggested by Mr. Chesshire, and adopted by the chemists for the plaintiff (with the exception of myself) in the late trial at Gloucester, referred to by that gentleman, and have, therefore, every confidence in its value, but have not yet satisfied myself whether it is superior to the plan I have hitherto adopted as above described.

I need scarcely add that it is not my intention to introduce the determination of precipitated phosphate into my ordinary analysis of superphosphate, nor include it in the

usual determination of soluble phosphates, but only give it when especially requested, and state it separately; since, whatever its agricultural value may be (space forbids my entering upon this part of the question), it is no longer soluble phosphate, and will not obviously pass as such when a definite percentage of soluble is bargained for; its value is, however, at the same time very superior, I consider, to undecomposed, or ordinary insoluble phosphates.

There is one objection to the introduction of this constituent into the ordinary analysis of manures—viz., that it would be likely to lead to greater discrepancies than occur at present, and which, I believe, are caused far more by a want of sufficient attention and method in the details of the analysis on the part of the operator than by any defects in the method of analysis.

Finally, as regards the ordinary determination of soluble phosphates in superphosphates, I find the method of precipitation perfectly satisfactory and consistent when carefully performed, and believe it to be by far the best method; while, in point of time, it leaves nothing to be desired under proper management. I gave much attention to the uranium process some time since, but did not find it satisfactory in the case of superphosphates made from a mixture of phosphates.

ON

SOME DERIVATIVES OF TRICHLORMETHYL-SULPHON-CHLORIDE.

By O. LOEW,

Assistant in the Chemical Department of the College of the City of New York.

THIS chloride, discovered by Berzelius and Marcet in 1812, was the subject of extended investigations by Kolbe. Since that time, no investigations on this compound have been made, although it possesses many interesting properties. I find that the simplest way to prepare it is the following:—300 grms. of bichromate of potassium, in pieces the size of a pea, 500 grms. of common hydrochloric acid, 200 grms. of nitric acid of the common strength, and 30 grms. of bisulphide of carbon, are mixed in a flask, filling it to one-fourth of its capacity, and loosely stoppered. It is kept cool in the beginning, and shaken from time to time. In about eight days the process is finished; in direct sunlight, only four days are required. By addition of water, the chloride and nitrate of potassium are dissolved, and there remains the insoluble trichlormethyl-sulphon-chloride. It is filtered off, washed, and pressed between sheets of filter-paper.

When this chloride is dissolved in absolute alcohol, and treated with sulphuretted hydrogen, sulphur is deposited, and hydrochloric acid and another compound of an acid character remain in solution. By neutralisation with dry carbonate of sodium, the sodium-salt of this new acid remains dissolved in the alcohol, and crystallises by evaporation in shining scales.

0·469 grm. yielded 0·146 grm. of sulphate of sodium = 11·33 per cent Na.

0·236 grm. yielded 0·490 grm. AgCl = 51·37 per cent Cl.

0·511 grm. yielded 0·605 grm. of sulphate of barium = 16·24 per cent S.

The sodium-salt of the trichlormethyl-sulphurous acid requires—11·14 per cent Na; 51·95 per cent Cl; 15·56 per cent S; 15·56 per cent O; 5·81 per cent C.

To obtain the free trichlormethyl-sulphurous acid, the sodium-salt is decomposed by dilute hydrochloric acid and agitated with ether. The ether yields, by evaporation, this new acid in radiating needles. Both the acid and its salts are not of great stability; at a moderate temperature, especially when water is present, decomposition takes place, and a very offensive odour is evolved.

The formation of this acid takes place according to the following equation:—

$$\underbrace{(CCl_3)SO_2Cl}^{\text{Trichlormethyl-sulphon-chloride.}} + H_2S = \underbrace{(CCl_3)SOOH}^{\text{Trichlormethyl-sulphurous acid.}} + HCl + S.$$

The decomposition of this acid and its salts, by bromine and nitric acid, is very striking; the acid disappears, and new insoluble compounds are formed.

The action of bromine is expressed by the following equation:—

$$\underbrace{(CCl_3)SOOH}^{\text{Trichlormethyl-sulphurous acid.}} + Br_2 = \underbrace{(CCl_3)SO_2Br}^{\text{Trichlormethyl-sulphon-bromide.}} + HBr.$$

And the action of nitric acid—

$$\underbrace{(CCl_3)SOOH}^{\text{Trichlormethyl-sulphurous acid.}} + \underbrace{NO_3H}^{\text{Nitric acid.}} = \underbrace{(CCl_3)SO_2(NO_2)}^{\text{Trichlormethyl-sulphon-nitride.}} + H_2O.$$

The trichlormethyl-sulphon-bromide is a white crystalline body of a faint acrid smell, insoluble in water but soluble in alcohol and ether. On the application of heat a part is sublimed without change, while another part is decomposed. Ammonia dissolves it with evolution of nitrogen.

0·358 grm. yielded 0·313 sulphate of barium, corresponding to 12·01 per cent S.

0·492 grm. yielded 1·158 grms. AgCl + AgBr, and this mixture yielded, by reduction, 0·808 Ag, which proportions correspond to 30·77 per cent Br, and 40·22 per cent Cl.

The theory demands 12·19 per cent S, 40·57 per cent Cl, 30·48 per cent Br.

When trichlormethyl-sulphurous acid is brought into contact with concentrated nitric acid, a violent reaction takes place, and a blue oil is deposited which loses nitrous acid by contact with the air, and is converted into a white crystalline body, the odour of which inflames the eyes and is very suffocating when inhaled. This is the trichlormethyl-sulphon-nitride, especially interesting in this, that a nitride of an organic sulph-acid has been hitherto unknown. It is insoluble in water, soluble in ether and alcohol. Water added to the alcoholic solution precipitates it unchanged. It does not melt in boiling water, but is volatilised with the steam. Ammonia dissolves it slowly, with decomposition: alcoholic solution of caustic potassa decomposes it quickly. When it is treated with zinc and hydrochloric acid, it disappears, and is converted into sulphydrate of methyl and ammonia—

$$\underbrace{(CCl_3)SO_2(NO_2)}^{\text{Trichlormethyl-sulphon-nitride.}} + 18H = \underbrace{CH_3SH}^{\text{Sulphydrate of methyl.}} + H_4NCl + 2HCl + 4H_2O$$

0·5285 grm. yielded 0·532 sulphate of barium and 0·973 AgCl, corresponding to 13·83 per cent S and 46·12 per cent Cl.

Theory demands 14·00 per cent S and 46·61 per cent Cl.

On treating trichlormethyl-sulphon-chloride with ammonia, trichlormethyl-sulphurous acid is formed in an unexpected manner, nitrogen is evolved, and the chloride is slowly dissolved. On evaporation, broad tabular crystals are obtained. In the mother liquor, there remains chloride of ammonium, some sulphate of ammonium, and a certain quantity of this new compound. The crystals must be re-crystallised with great care, because, at a moderate temperature, an acid reaction sets in and a partial decomposition begins. These crystals show, with bromine, as well as with nitric acid, the formation of the above-mentioned bromide and nitride. The action of the nitric acid is extremely violent.

By mixing with diluted hydrochloric acid, and agitating with ether, the above-mentioned trichlormethyl-sulphurous acid is obtained.

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* C=12 S=32 O=16.

0·431 grm. yielded 0·911 grm. AgCl = 52·24 per cent Cl.
0·668 grm. yielded 0·725 ammonio-chloride of platinum = 6·80 per cent N.
0·753 grm. yielded 0·894 grm. sulphate of barium = 16·23 per cent S.
Theory demands 53·11 per cent Cl, 6·98 per cent N, 15·96 per cent S.

The crystals are, therefore, the ammonium salt of the trichlormethyl-sulphurous acid, and their formation can be expressed by the following equation :—

$$3\underbrace{[(CCl_3)SO_2Cl]}_{\text{Trichlormethyl-sulphon-chloride.}} + 8H_3N = 3\underbrace{[(CCl_3)SO_2H_4N]}_{\text{Trichlormethyl-sulphite of ammonium.}} + 2N + 3H_4NCl$$

On treating trichlormethyl-sulphon-chloride with cyanide of potassium, evolution of cyanogen and hydrocyanic acid takes place, and the potassium salt of trichlormethyl-sulphurous acid is formed—

$$(CCl_3)SO_2Cl + 2KCy = (CCl_3)SOOK + KCl + 2Cy.$$

But, when the solution is hot and very concentrated, there is, also, another derivative of this acid formed, one atom of Cl being replaced by one atom of OH—

$$(CCl_3)SOOK + H_2O = (CCl_2OH)SOOK + HCl,$$

which latter decomposes another part of the cyanide of potassium.

A glance at the following formulæ will show the relation between these new bodies and several others already known :—

Trichlormethyl-sulphon-chloride $(CCl_3)SO_2Cl$ (Kolbe).
Trichlormethyl-sulphon-bromide $(CCl_3)SO_2Br$.
Trichlormethyl-sulphon-nitride $(CCl_3)SO_2(NO_2)$.

Trichlormethyl-sulphur*ic* acid $(CCl_3)SO_2OH$ (Kolbe).
Trichlormethyl-sulphur*ous* acid $(CCl_3)SOOH$.
Methylsulphur*ic* acid $(CH_3)SO_2OH$ (Kolbe).
Methyl-sulphur*ous* acid $(CH_3)SOOH$ (Hobson).

—*American Journal of Science.*

ARTIFICIAL PRODUCTION OF ICE,

By P. H. VANDER WEYDE, M.D.

CALCULATION OF THE AMOUNT WHICH CAN BE PRODUCED FROM A GIVEN AMOUNT OF COAL IN THE MODERN ICE MACHINE.

THE amount of ice produced by an ice machine, worked by means of an exhaust or condensing air-pump, driven by steam power, is easily determined, theoretically, from the amount of coal burned in the furnace of the steam boiler. It has been proved that the combustion of one pound of anthracite coal produces, in round numbers, 14,000 units of heat, and that in order to freeze water of 72° Fahr., it is necessary to abstract, besides 40° of sensible heat, 140° of latent heat—together 180°—which, for one pound of water is, of course, equivalent to 180 units of heat. As this number of the units is the eightieth part of the 14,000 units produced by the combustion of one pound of coal, it is clear that the heat produced by the combustion of one ton of coal is equivalent to the heat to be abstracted from 80 tons of water of 72°, in order to change it into ice.

But in practice we find here exactly the same state of affairs as is the case with the steam engine. Theoretically, a steam engine ought to produce at least 700 units of force (foot-pounds) for every unit of heat consumed; in practice, good machinery only produces from about 70 to 100 foot-pounds, from about one-tenth to one-seventh part of the theoretical amount. In the best ice machines thus far constructed, instead of freezing 80 tons of water, for every ton of coal consumed, only from about 8 to 11 tons of ice are produced, also, from one-tenth to one-seventh part of the theoretical amount, proving, thus, the remarkable fact, that in both the steam engine and the ice machine, exactly the same relation exists between the theoretically calculated effects and the practical results.

As, however, all the best ice machines accomplish the conversion of the heat of the fuel into the freezing operation by the intervention of a steam engine, the fact that they practically produce only from one-tenth to one-seventh of the amount of the cold they theoretically should produce, is solely due to the other fact, that the steam engine itself practically produces only from one-tenth to one-seventh of the amount of power which would be strictly equivalent to the number of heat units consumed. It must not be lost sight of that it is only the power of the steam engine which generates the cold in the freezing machines, and that, therefore, improvements in the steam engine, which bring its practical results nearer to the theoretical standard, will at once exert their influence on the amount of ice the ice machines can produce, and, consequently, also on the cost of the ice manufactured in these machines.

Moreover, it appears that the kind of freezing machines in question, which convert power into cold, notwithstanding they are yet in their infancy, have already attained such a degree of excellence, that they are ahead of that class of machines which convert heat into power, either by steam, hot air, or any other possible means, as it is proved that they produce the full theoretical equivalent of cold (negative heat) for the number of foot-pounds employed; namely, cooling one pound of water one degree for a power equivalent to 700 pounds, descending one foot, which, expressed in the adopted scientific manner, is one unit of negative heat for every 700 foot-pounds consumed.—*Scientific American.*

ON A NEW SOURCE OF THE FIRST TERMS OF THE FATTY ACIDS,

AMONGST OTHERS OF PROPIONIC ACID.

By M. BARRB.

THE dry distillation of wood produces a very acid liquid, from which acetic acid is extracted in large quantities. The general mode of purifying the latter is to saturate the liquid with carbonate of soda, when concentration produces crystallised acetate of soda and mother liquors. These latter diffuse a strong smell of molasses. When a certain degree of concentration has been reached, the crystals cease to form, and, if evaporation be continued, they assume a confused and hygrometric mass. This latter has been the subject of my experiments. On treatment with sulphuric acid, it decomposed, forming two liquid films, which were mingled into one by the addition of water. Instead of separating these acids by fractional distillation, I operated upon their ethers, first separating them into volatile portions—

I.	Between	55°	and	58°.
II.	,,	74°	,,	77°.
III.	,,	95°	,,	98°.
IV.	,,	114°	,,	119°.
V.	,,	133°	,,	136°.
VI.	,,	162°	,,	165°.

and then saponifying with baryta.

I. The baryta salt produced by the ether boiling at 55° or 58°, being heated with monohydrated sulphuric acid, disengaged pure oxide of carbon. This salt reduced nitrate of silver at the boiling point; formed with perchloride of mercury a white precipitate of protochloride, &c.; and it presented the crystallographic characteristics of formiate of baryta. The ether produced was therefore nearly pure ethylformic ether.

II. The baryta salt No. 2 was acetate, as might be foreseen.

III. Baryta salt No. 3, after purification by successive crystallisations, assumed the form of perfectly defined oblique prisms. The dry salt remained unaltered in the air. Its solution, left in contact with the atmosphere, evolved a slight odour, which proved the commencement of decomposition. When dried at 100°, it decomposed slowly, losing its water of crystallisation, and changed into a salt insoluble in water. It was impossible to obtain a sensibly-pure salt, except by evaporation at a very low temperature in a receiver whose atmosphere had been dried by sulphuric acid. Analysis gave 50·7 of baryta per cent of the salt. The propionate of baryta, according to the known formula, $C_6H_5BaO_4.HO$, contains 50·7 per cent of baryta.

The lead-salt, dried at 110°, yielded a syrupy, transparent, non-crystallisable mass.

IV. Baryta salt, No. 4, took the form of flattened prisms, melting below 100°. On analysis, it yielded 44·0 per cent of baryta; the butyrate of baryta, $C_8H_7BaO_4.2HO$, contains 44·6. This salt, when treated by chlorhydric acid and chloride of calcium, decomposes, and leaves a film of butyric acid floating on the surface of the liquid. Treated with a mixture of alcohol and sulphuric acid, it forms ethyl-butyric ether, having the characteristic smell of pine-apple.

V. Ether, No. 5, treated like the preceding, gives a salt which crystallises in thin flakes which effloresce quickly on contact with the air. The dry crystals, finely powdered and thrown into water, perform rapid gyrations.

When again dissolved in water and treated with sulphuric acid, an acid is formed, insoluble in water, distilling between 172° and 178°; this is valerianic acid.

VI. Baryta salt, No. 6, was crystallisable, but with difficulty. Its solution, treated with sulphuric acid, sets free a liquid acid lighter than water, but slightly soluble in the cold, soluble when warmed, soluble in every proportion in alcohol, distilling at from 198° to 205°. When saturated by a standard solution of caustic baryta, its equivalent was found to be 118·1, whilst that of caproic acid is 116. The difference of the equivalent is owing to the presence of a small quantity of acid boiling at a higher temperature, which hinders the crystallisation of the caproate.

On examining the relative proportions of these acids, formic acid is found to occur in small quantities only. Acetic acid is most abundant, the relative proportion of each diminishing as it rises in the series.

Propionic acid, whose soda-salt is very soluble in water, is found thus concentrated in the preparation of acetate of soda. The mother liquors, which contain a large quantity, might become an abundant source of its production, which has hitherto been attended with difficulty. The transformation of soda-salt into ethylic ether allows of complete purification.

This series of homologous bodies produced by a single reaction is dependent upon a general law in organic chemistry, that of simultaneous production; either in the order of analysis, the homologous bodies being produced by successive divisions, or in the order of synthesis, being formed inversely by successive additions.—*Comptes Rendus*, vol. lxviii., p. 1222.

Non-Poisonous Colours.—We have received two samples from Mr. F. Pettit, viz., yellow zinc and green zinc; and, after having tested them we are satisfied that the statements made by the makers of these colours are correct. Of the beautiful yellow and green pigments we have had the opportunity of testing, we affirm with pleasure that (1) they are not poisonous; (2) they do not become discoloured by the effects of burning gas; (3) they are not affected by sulphuretted hydrogen gas, and are not altered in shade—as far especially as the green is concerned—by artificial light. For paper-stainers, the manufacture of surface-coloured paper, for mixing with plaster-of-Paris for ornamental stucco work on walls, these colours will answer well, as they also will for mixing oil pigments, while, for pigment cotton printing, chromo-typography, and lithography, they will supply colours of great brilliancy, durability, and quite sufficient body.

ON A NEW REACTION OF PHENOL.

By C. CRUMP.

If fragments of caustic potash be added to a solution of phenol in chloroform, the potash becomes covered with a rose-coloured coat, which gradually dissolves in the liquid. Considerable heat is produced, and the action goes on rapidly until the mixture which at first was red has become brown and thick. It then slackens, but may be renewed by a gentle heat, until potash has been added equal in quantity to about three times the weight of the phenol.

The final product of the reaction is a brown amorphous mass, soluble in alkaline liquids, and precipitated therefrom by acids. It seems to be a mixture of two substances, differing in solubility in alkalies and in their behaviour with strong sulphuric acid.

The first substance dissolves very easily in carbonate of potash or soda, less readily in strong sulphuric acid. From the latter solution a precipitate is thrown down by water, which behaves with alkalies like rosolic acid.

The second substance dissolves less freely in alkalies, very easily in strong sulphuric acid, forming a brown liquid from which nothing is precipitated on dilution. With tetrachloride of carbon instead of chloroform no action takes place in the cold; at 100° C. the liquid assumes the colour of rosolic acid.

When creosote from wood-tar is treated with chloroform and caustic potash, a reaction takes place very similar to that with phenol, but the product of the reaction is quite different, forming with sulphuric acid a deep crimson solution, from which a dingy green precipitate is thrown down by dilution. Moreover, the substances produced from phenol in alkaline solution colour silk or wool brown, while those from creosote have no colouring power.

NOTICES OF BOOKS.

Alkali Act, 1863; *Fifth Annual Report by the Inspector of His Proceedings during the year* 1868. Presented to both Houses of Parliament. 1869. Eyre and Spottiswoode.

It will be in the memory of all of us that, in 1863, Lord Derby brought in a bill for the removal of the nuisance caused by alkali works. It had long been noticed that, in the neighbourhood of such works, no kind of vegetation could flourish; and other evils were found to result. It was hence proposed that means should be adopted for preventing the escape of hydrochloric acid into the air, and that an Inspector should be appointed to see that the enactments of the bill were properly carried out. Inasmuch as the bill was entirely free from any party influence, it rapidly received the assent of both sides of both Houses, and became law somewhat more than five years ago. Dr. Angus Smith was appointed Inspector, and he has annually issued a report, that which we are about to notice being the fifth.

In the report for 1867, the escape from the hydrochloric acid condensers was stated to be under 1 per cent, while 2 per cent was allowed for leakages through the brickwork. No diminution of this amount can be shown for the succeeding year, although, in the case of "open-furnace works," the escape is much smaller, and is considered to be not more than 0·5 per cent, leakage included. Various new furnaces have, however, been constructed, and it is confidently expected that the escape may ultimately be reduced to almost a vanishing quantity.

From page 6 to page 22, the space is occupied by accounts of various alkali works, and the improvements effected during the year; and first in the case of works with open roasters:—

No. 53. To each condenser is connected a wash-tower

containing 400 cubic feet of condensing space. The escaping gases were found to be reduced in temperature 400° F. between the roaster and condensers; the acid obtained was of 19° Twaddle, and the escape was 0·9 per cent.

No. 115. These are new works, and consist of one decomposing pan, a pan condenser 60 feet high, containing 2,400 cubic feet of condensing space, and one roaster condenser with two shafts, each containing 1400 cubic feet. Charge, 6 cwts. per hour; escape, 1·9 per cent.

No. 68. The escape varied from 1 to 5 per cent.

Secondly, in the case of works with close roasters:—

No. 45. March 3.—Two pots with flanges and rims, and close furnaces are used. A large quantity of acid found in the flue. April 7.—A large quantity of acid found in flue. July 16.—A new furnace, constructed with great care, was set to work; but the results were unsatisfactory, and the escape large. Ultimately, after many trials, another new furnace was set to work, on November 12th, and the result was found to be satisfactory, and the escape of acid small. However this may be, the above results sufficiently indicate the advantage of the "open-furnace" system, unless there are certain drawbacks connected with it in reference to other matters than the provisions of the Alkali Act. The testing-glasses of Mr. Kane continue to work well, and to indicate with precision an undue escape of acid into the flues. The main difficulty appears to be to prevent leakage through the hot brick-work of the furnaces, since the amount of acid escaping with the smoke can be reduced by condensation to certainly 0·5 per cent, and, by lessening the velocity of the escaping current, to even less than this.

In regard to the matter of cooling flues, experiments have been made as to the relative cooling powers of brick and iron flues, with the following results:—

An underground brick flue cooled 7° F. per 10 feet.
An overhead brick flue cooled 18° per 10 feet.
An overhead cast-iron flue cooled 30° per 10 feet.

Thus the iron flues are most advantageous as regards cooling effect, but they are somewhat rapidly acted upon by the evolved gases, and do not last so long as brick flues. The following analyses show the composition of the deposit from cast flues in Mr. Mease's works. The "up pipe" was 65 feet from the furnace, and the temperature 468° F. The "down pipe" was 130 feet from the furnace, and the temperature 289° F.

Analysis of the Deposit in Cast-Iron Flues.

	Up pipe.	Down pipe.
Peroxide of iron	19·866	26·946
Alumina	3·171	4·614
Lime	0·371	0·486
Magnesia	0·414	0·298
Soda	11·311	2·808
Sulphuric acid	53·212	48·077
Chlorine	2·141	2·034

Water, loss, &c., in addition.

A number of estimations of the sulphur in coal have been made by Dr. Angus Smith and Mr. Fletcher. An examination of 70 specimens of South Lancashire coal by the former showed an average percentage of 1·1 of sulphur; while the examination of some specimens of St. Helen's coal by Mr. Fletcher showed a minimum of 0·6, and a maximum of 2·22, per cent of sulphur. If 300 cubic feet of air are used to burn 1 lb. of coal containing 2 per cent of sulphur, the amount of sulphurous acid in the smoke will be a little more than 1 grm. in a cubic metre, since that is equal to 35·318 cubic feet.

A number of very interesting analyses are given of the composition of coal-smoke (pp. 26 to 34), from which we extract the following:—

Chimney of a sugar refinery, 200 feet high. Smoke taken from a height of 30 feet from the ground. Speed of smoke, 12 feet per second. Internal diameter of the chimney at 30 feet from the ground, 10 feet. Amount of coal burnt per day, 35 tons.

	Black smoke.	Common brown smoke.
CO_2	6·64	4·26
CO	0·40	—
O	11·17	16·63
H	—	—
CH_4	0·02	—
C_nH_{2n}	—	—
N	81·77	79·11
	100·00	100·00

One hundred cubic feet of black smoke were found to contain, in addition to the above gases, 1047·44 grains of water, and 18·52 grains of soot.

It was considered very advisable that the condition of the air at some distance from alkali works should be known; and this, as regards its acidity, would be obviously best determined by examining the rain-water collected direct in porcelain vessels.

The maximum acidity (*calculated as sulphuric acid*) of rain which fell in Manchester in 1857 was 7·3960 grains per gallon, and the minimum 0·3169 grains per gallon.

Pendleton, Manchester. 1857.

Maximum acidity, 3·3810 grains per gallon.
Minimum ,, 0·2641 ,, ,,

Hulme, Manchester. 1857.

Maximum acidity, 2·5886 grains per gallon.
Minimum ,, 1·3734 ,, ,,

Rain; Manchester. 1868.

Maximum HCl, 1·2775 grains per gallon.
Minimum ,, 0·0278 ,, ,,
Maximum $HOSO_3$, 5·6000 ,, ,,
Minimum ,, 1·4000 ,, ,,

The total acid in rain collected from various sources bears the following relationship:—

Row, Dumbartonshire	100·00	= 1
Whiston, ten miles from Liverpool	470·67	= 4¾
Birkenhead	528·29	= 5¼
Liverpool	938·21	= 9¼
Waterloo, on the shore	961·98	= 9½
Newcastle-on-Tyne	1054·73	= 10½
Manchester	1175·54	= 11¾
Near an alkali work	1539·27	= 15¼

We can scarcely be surprised, after glancing at this table, at the rapid decay of stone in certain localities, compared with others, and the long endurance of buildings of antiquity which are far from large towns, and in a pure and open air—such as the Parthenon, and the Pyramids of Egypt.

Some very interesting drawings are given by Dr. Angus Smith, on page 46, of the microscopic appearance of rain-water residues; and we are told that oxide of iron, sulphate of soda, phosphates, chloride of ammonium, and other substances may be readily detected in the rain of some localities. We are surprised to find that Dr. Smith has not examined any of the residues spectroscopically, as this would appear to offer the best means of detecting the minute traces of substances which are present; or is it that, in point of fact, almost every element would be detected by such an infinitely delicate test? Certainly, Bunsen has found that lithia is generally present in the air near the sea shore. According to M. Robinet (*Comptes Rendus*, 1863, p. 493), the Paris rain-water contains a substance which gives a garnet-red precipitate with nitrate of silver. In a summary of results obtained, Dr. Smith gives, among others, the following conclusions:—

"The rain from the sea (Western Islands) contains chiefly common salt, which crystallises clearly.

"The sulphates increase inland before large towns reached.

"The sulphates rise very high in large towns, because of the amount of sulphur in the coal used, as well as decomposition.

"When the air has so much acid that two or three grains are found in a gallon of the rain-water, or forty parts in a million, there is no hope for vegetation in a climate such as we have in the northern parts of the country.

"Free acids are not found with certainty where combustion or manufactures are not the cause.

"Experiments in the direction indicated above may enable us to study and express in distinct language the character of a climate, and certainly of the influences of cities on the atmosphere."

In the Appendix to the Report will be found an interesting letter by Mr. A. E. Fletcher, "On the Speed of Air in Flues," as determined by the ether anemometer invented by himself, and described some time ago in this journal (vol. xvi., p. 141). The tables will be found of especial value: the one giving the corrections for temperature in a range of from 0° to 1000° F.; the other to show the conversion of the anemometer indications into the speed of the air current, with a range from 0·903 to 40·37 feet per second.

The report, as a whole, contains much valuable information, and is an important contribution to our knowledge of technology. Its range extends far beyond the more immediate subject of inquiry. The composition of the air of towns, as indicated by the solid residue of the rain, affects all of us, not alone as regards our health, but further, in relation to the preservation of our national monuments and public buildings. The comparison of the death-rate of various towns indicates the influence of impure airs upon the duration of our lives. Dr. Angus Smith has done much towards the examination of the influences of impure air and water upon mankind, and we hope he will continue his labours in the same fertile field.

CORRESPONDENCE.

IMPURITY OF INDIGO.

To the Editor of the Chemical News.

Sir,—Having been in the habit of experimenting on indigo, in order to arrive at a relative value of different samples, in order to rate the proper quantities for dyeing stated quantities of fabric, I was not under the necessity of examining the article for anything but its active colouring principles. But, a short time since, in making sulphate of indigo, I poured the solution from the dregs, and, throwing the sediment away, I kept the solution in a glass-stoppered bottle, exposed to strong light, and, at the end of a couple of months (not being at leisure to attend to this lot sooner), I found, on examination, that the contents of the bottle were almost solid, only about one-fifth of the whole being liquid.

I filtered the fluid portion from the solid, and obtained only a very small quantity of indigo carmine as result of examination, the solid mass being composed of a dirty-blue powder, which I washed away, being anxious to get at the principal matter in the mixture. After washing thoroughly, I obtained a heavy lot of fine, white needles, which had formed during the time that the solution was standing. Some blue spots adhering, I washed with dilute nitric acid, and then with water, obtaining the crystals tolerably clean.

I have consulted Watts's "Dictionary," and other works at my command, and, of all the reactions mentioned in connection with any of the salts of indigo, not one of them makes an impression on the mass.

Tested with SO_3, NO_5, HCl, and with aqua ammonia, sulphuric ether, alcohol, hot and cold water, also a solution of caustic potassa, none of which have any effect, as a drop on glass dries off without leaving a crystalline residue to show solution having taken place.

Heated to a cherry-red heat, the silky needles lose their pearly brilliancy, but still obstinately refuse to answer any of the reagents applied to them.

I have not applied hydrofluoric acid for fear of using all my stock of crystals up without arriving at a satisfactory solution, and have none left to send you.

I transmit herewith the balance of the crystals left in good order for your inspection, hoping you can throw some light on the compound.

The indigo from which these were obtained is an article known in the American market as "Madras" indigo, and, as this must indicate very extensive adulteration, I have ventured to trouble your patience with a history of it, in the hope that it may be of interest. If the subject is worth further efforts, I am ready to follow any suggestions as to the mode of procedure you may see fit to offer.

In conclusion, I will state that the SO_3 used to form the sulphate was bought as being chemically pure, but I did not test it; although, if it had been sophisticated with sulphate of soda, the result would not have been an insoluble compound, and, as the indigo was pounded fine in a mortar, and passed through a very fine sieve, the crystals could not have been in their present shape previous to the examination of the specimen.—I am, &c.,

New Berne.

New Berne, N.C., U.S.A., July 27th, 1869.

[The substance of which our correspondent sent a sample proves to be soluble in boiling dilute hydrochloric acid. This solution yields a dense precipitate with chloride of barium, a flocculent precipitate with ammonia (alumina), and a strong precipitate with oxalate of ammonia. It is evidently a mixture of sulphate of alumina and sulphate of lime: other tests which have been applied confirm this statement. If the indigo had been ignited, our correspondent would have been able to judge of its quality from the quantity of ash. Good indigo leaves from 4·5 to 5·0 per cent of ash; but the less the better, of course. A mixture of pipe-clay and milk of lime is frequently used in the preparation of indigo; hence the phenomenon which puzzled "New Berne."—*Ed.* C. N.]

IMPROVED BUNSEN'S FILTER.

To the Editor of the Chemical News.

Sir,—Bunsen's filter being now in such general use, and such a necessary adjunct to a good laboratory, it seemed to me that any small improvements in connection with it could not fail to interest your readers.

In the place of the cone of platinum foil recommended by Bunsen, I now use a cone made either of platinum or copper gauze. When the fluid which passes through the filter does not act on copper, I prefer the latter. The cones are cut just as Bunsen describes, but can be fitted to the funnel direct, that is without the use of a matrix of plaster-of-Paris. This is accomplished by pressing the cone into the funnel to be used, with a piece of wood turned as nearly as possible to the proper angle. I may add that during the last three months, in which these cones have been in almost daily use, I find them to filter much quicker than the foil cones, and with quite as little risk of breaking the paper.—I am, &c.

R. S. Dale, B.A.

Cornbrook Chemical Works, Hulme, Manchester, September 8th, 1869.

London Gas.—It is stated that one hour after the gas of London is lighted the air is deoxidised as much as if 500,000 people had been added to its population. It is also stated that, by the burning of gas twenty-four hours in London, more water is produced than would supply a ship laden with emigrants on a voyage from England to Australia.

MISCELLANEOUS.

Professor Church, M.A.—The *Lancet* of August 28th, in noticing a report read at the Exeter meeting of the British Association, "On the Spectroscopic Examination of Animal Substances," refers to Professor Church's investigation of the red colouring matter of the wings of the turaco, and believes that Professor Church is the Assistant Physician to St. Bartholomew's Hospital. We have been requested to state that the investigator is not Dr. W. Church of St. Bartholomew's Hospital, but A. H. Church, M.A., Professor of Chemistry at the Royal Agricultural College, Cirencester.

New Chemistry Chair at Anderson's University.—A special meeting of the trustees of Anderson's University was held on Wednesday last for the purpose of considering the proposal of Mr. James Young, of Kelly, to found a chair of technical chemistry in connection with the University. Mr. Harvie was called to the chair. A letter was read from Mr. Young, intimating his intention to invest £10,500, in six trustees and himself, for the purpose of establishing a chair of technical chemistry, and requesting the managers and trustees to lease to him the building adjoining the University recently presented by Mr. William Euing, to be altered and fitted up by the trustees. The managers had given their assent, and they now asked the concurrence of the trustees. The Secretary read the deed of trust by Mr. Young in favour of his trustees, directing how the 10,000 guineas were to be appropriated in providing for the lecturer, providing apparatus, altering the building, &c. The trustees were empowered to establish bursaries, scholarships, &c. His six trustees must be trustees of Anderson's University. It was intimated that Mr. Young, with the consent of his fellow trustees, appointed Mr. W. H. Perkin, F.R.S., to the lectureship. This gentleman, like Mr. Young himself, is the founder of an important chemical industry, he being the first discoverer in the department of the aniline or coal-tar dyes. The offer was accepted, with one dissentient.—*Scientific Opinion.*

Spiders' Silk.—A bar of iron 1 inch in diameter will sustain a weight of 28 tons; a bar of steel 50 tons; and, according to computation, based upon the fact that a fibre only 1-4000th of an inch in diameter will sustain 54 grains, a bar of spiders' silk 1 inch in diameter would support a weight of 74 tons.

Contribution to the History of Pyrrol.—N. Lubavin.—It is pretty well known that this substance is the product of the destructive distillation of bones, pit-coal, and other nitrogenous substances. Pyrrol has been only slightly submitted to research. It is known to have the formula C_4H_5N. It does not form salts; is not decomposed by fusing with caustic potassa. Treated with acids, it yields pyrrol-red; while it has the property of colouring a piece of fir-wood, previously moistened with hydrochloric acid, red. About two years ago, M. Goldschmidt discovered that, when pyrrol is oxidised with moist oxide of silver, it is converted into a crystalline substance endowed with the properties of an acid. However, only a very small quantity of this substance was obtained by him. M. Lubavin, although operating upon large quantities of pyrrol, succeeded no better than M. Goldschmidt, when repeating his researches on pyrrol and its oxidation by means of oxide of silver; while the very small quantity of the crystalline substance obtained by him by this reaction proved to be as ready a reducing-agent for the said oxide as the pyrrol itself. Pyrrol appears to be extremely indifferent to any reagents at all, or, if acted upon, is readily converted into pyrrol-red. Sodium does not affect pyrrol at the ordinary temperature of the air: when heat is applied, some gas is disengaged. Potassium, however, acts strongly upon pyrrol; a large quantity of gas is disengaged; heat is developed; and, on cooling, the entire mass solidifies, forming a crystalline compound; this appears to be pyrrol-potassium, since, on treating it with water, pyrrol is obtained unchanged, while, on treating it with iodide of ethyl, ethyl-pyrrol is produced. The potassium combination has the formula C_4H_4KN. When large quantities of pyrrol are operated upon, some resinous substance is also produced. Ethyl-pyrrol is a colourless liquid, which, however, soon becomes first yellow, next red. Its smell is akin to that of oil of turpentine. It is hardly at all soluble in water, and specifically lighter than that fluid. Ethyl-pyrrol becomes resinous when exposed to air; is soluble in hydrochloric acid, thereby becoming deep-red coloured, and emitting dense white fumes. On boiling this solution, no solid substance is deposited, but, on addition of an aqueous solution of caustic potassa, an amorphous, solid substance is precipitated. The vapours of ethyl-pyrrol have the same characteristic property as pyrrol, viz., to render red-coloured a piece of fir-wood previously moistened with hydrochloric acid. The percentical composition of ethyl-pyrrol for the formula $C_4H_4(C_2H_5)N$ = Carbon, 75·8; hydrogen, 9·5; nitrogen, 14·7. The boiling point is between 160° and 175° C.—*Berichte d. Chem. Gesel. z. Berlin.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, August 16, 1869.

This number contains, among a large number of purely mathematical, mathematico-physical, and papers on other subjects not at all allied to chemistry, the following memoirs:—

Constitution of Luminous Spectra.—M. Lecoq de Boisbaudran.—The author says, in the year 1805, I stated "that, when the spectral rays of the metals of the alkalies and alkaline earths are classified according to their refrangibility, they are placed according to the chemical properties and the atomic weights of these bodies." The author now says—"I can explain the formation of the spectra by the four following points:—1st, the molecules should present certain inequalities, and should not be solids rotating round a circular axis; 2nd, they must be in rapid motion; 3rd, that motion ought to be an eccentric elliptic; 4th, the ellipse itself should move in a perihelical manner. From the combination of the spherical and elliptical movements, I can explain the formation and the entire mode of existence of a spectrum; that is to say, groups which are repeated in several points of the luminous part, shadowed rays or stripes decreasing either towards the right or left hand, and repetition of these stripes in the spectrum."

Researches on the State Salts are in when Dissolved in any Menstruum.—MM. Berthelot and St. Martin.—The authors find—1st, that there do not exist in solution acid salts formed by a monobasic acid; 2nd, the acid salts formed by a bibasic acid are, when in solution, partly decomposed; 3rd, the quantity of salt thus decomposed increases steadily and continuously when dilution takes place; 4th, the quantity which is decomposed varies according to the relation existing between the neutral salt and the excess of acid; the stability of the acid-salt is increased by the presence of a neutral salt, or by the presence of excess of acid. The authors have, moreover, found that—1st, the acetates of the alkalies are entirely decomposed, when in aqueous solution, by sulphuric, hydrochloric, oxalic, and even tartaric acids; 2nd, ammonia, when added to solutions of acetate or oxalate of potassa, or soda, in solution, does not seize upon any of these acids; 3rd, oxalic acid partly decomposes a solution of chloride of sodium, when, in a litre of water, 14 grms. of oxalic acid and 20 grms. of chloride of sodium are dissolved (larger quantities of these substances cannot be taken, on account of the difficult solubility of binoxalate of soda). The authors found that about 1-10th of the oxalic acid was converted into binoxalate of soda.

Fermentation of Fruit.—MM. Lechartier and Bellamy.—In this paper the authors relate their experiments whereby they discovered that fruit—apples and pears, more especially—when kept, gives off carbonic acid; but, at the same time, in the interior of the fruit, alcohol and acetic acid are formed. We quote the following figures:—Duration of experiment, 184 days; weight of apples, 348·8 grms.; loss of weight, 14·3 grms.; loss of sugar, 26·0 grms.; gas given off, 13·10 grms.; alcohol formed, 10·01 grms.; acetic acid formed, 0·11 grm. From these and some other experiments made by the authors, it appears that fruit of the kind alluded to is best and most advantageously kept so as to admit of free circulation of air round every individual fruit as much as possible. To keep fruit in closed vessels causes rapid destruction.

On Bromotoluen and the Toluidines derived therefrom.—MM. Rosenstiehl and Nikiforoff.—This paper is a critical review of the labours of MM. Koerner, Huebner, and Wallach, and not suited for abstraction.

On Propylamine.—M. Silva.—The substance obtained by this author, by means of a complicated process, is a liquid exhibiting a strongly ammoniacal smell; very alkaline, inflammable, precipitating solutions of alumina, and re-dissolving the precipitate thus formed; also precipitating solutions of salts of magnesia, nickel, cobalt, and iron; boiling point about 50°; vapour density referred to air, 2·01; specific gravity at 0°, 0·7283; formula—

$$(CH_3—CH_2—CH_2)\left.\begin{matrix}\\ H\\ H\end{matrix}\right\}-N.$$

In 100 parts:—C, 61·01; H, 15·26; N, 23·73. The author has studied some of the salts this basis forms.

Constitution of Pseudotoluidine.—M. Koerner.—The author discusses in this paper the correctness or incorrectness of certain results published on this subject by M. Rosenstiehl. The paper is full of formulæ and not well suited for abstraction.

Testing the Antiquity of Manuscripts by means of Studying the Age of the Ink Employed in Writing it.—M. Gaultier de Claubry.—The chief result the author points to is that M. Carre's method alluded to by us in a former number of an abstract of this periodical, is entirely unfit to be used as a test for indicating the age of any writing.

Synthesis of Crotonic Aldehyde.—MM. Paterno and Amato.—The authors have tried, but in vain, to prepare this aldehyde by heating, in sealed tubes, aldehyde and chloride of ethyliden. The reason that they publish this, as they themselves confess, very imperfect work, is due to the publishing of the results of experiments on this subject by M. Kekulé.

Preservation of Stone from the Ravages of Cryptogamic Plants by means of the Oxide or Salts of Copper.—M. Robert.—The gist of this paper is, that the pedestals upon which are placed statues made of bronze, or to which copper ornaments are added, are protected by the salts of copper which are gradually formed under the influence of wind and weather; and these salts, being washed down by rain, prevent, by their poisonous action, the formation of small cryptogamic plants, and hence, also, prevent the decay and deterioration of the stone. The author thinks that salts of copper, or copper or bronze ornaments, might be applied successfully to pedestals, as well as buildings, in order to preserve the stone they are made of from decay, the chief cause of which is, according to the author, the growth of minute cryptogamic plants.

We learn from this number that, on the 8th of April last, the Imperial Academy of Sciences of St. Petersburg appointed a committee with a view of propounding measures to be taken in order to submit to an international committee several questions relating to the making of standard weights and measures according to the decimal system. The report of that Russian committee was read at this meeting of the French Academy, and gave rise to a lengthy discussion. The chief points of the Russian report may be briefly stated as follows:—That steps be taken by the Academy of St. Petersburg to induce the Russian Government to use its influence to invite a meeting of delegates of all foreign states, in order to discuss and regulate everything requisite to the proper manufacture of standard weights and measures according to the decimal system; the place of meeting to be afterwards designated; and that M. Jacobi be requested to bring this matter before the meeting of the British Association for the Advancement of Science, at Exeter, and be also requested to urge the necessity of the general adoption of the metrical system by all men of science in all countries.

Bulletin de la Société Chimique de Paris, August, 1869.

From the abstracts of the *proces verbaux* of the meetings of this Society, held on the 4th and 18th of June last, and published with this number, we learn that M. Longuinine spoke about his—

Researches on Birch-Wood Tar.—When this tar is distilled along with water, there is obtained a light, yellowish-coloured oil, which, on being treated with caustic potassa, yields a crystalline compound, due to a peculiar phenol, which constitutes about 1-15th of the entire quantity of oil obtained. The remainder of this oil yields chiefly tereben, boiling and distilling over between 160° and 180°. The phenol obtained exhales the peculiar and well-known smell of Russian leather, chiefly employed for bookbinding purposes.

M. Friedel spoke on the—

Formation of the Chlorides of Acids.—Anhydrous phosphoric acid does not, at 0°, act upon crystallised acetic acid; when this mixture is treated with dry hydrochloric acid gas, chloride of acetyl is formed.

M. Joffre communicated the composition of a native crystalline carbonate of soda found in Fezzan (a great oasis in Tripoli, Africa); this salt is a sesquicarbonate, $2NaO,3CO_2+4HO$.

M. Thiercelin called attention to the formation of the saltpetre beds on the coast of Peru, and states that the beds situated close to sources of water impregnated with common salt are yet quite free from iodine.

M. Bouchardat said that, according to his experiments, cinchonine fuses at from 256° to 262°. Kept at an elevated temperature in a current of carbonic acid, this base begins to volatilise, without decomposition, at 275°; when, however, cinchonine is kept for a length of time at 150°, it is converted into liquid volatile bases.

This number contains the following original papers:—

Synthesis of a New Butylen, Ethyl-Vinyl.—M. Wurtz.—The author mixes zinc-ethyl and bromide of ethylen, heats in a sealed tube up to 140° for some hours, and next leaves the tubes quietly standing for several weeks. Previous to opening the tubes, they are placed in a strongly-cooling mixture, and arrangements made to collect the gas which may escape on opening the tubes into bromine. After proper purification, the bromide obtained constitutes a perfectly colourless liquid boiling at about 166°; sp. gr. at 0°, 1·876. The ethyl-vinyl obtained from this bromide boils at 5°; and, on being re-converted again into a bromide, that latter compound boils again at 166°.

Synthesis of Aromatic Acids.—M. Wurtz.—The method described by the author consists in treating an organic chloride or bromide with chloroxycarbonic ether and sodium-amalgam. In this way, the chlorine or bromine seized upon by the sodium-amalgam is replaced by $CO_2(C_2H_5)$. The author has applied this method in some instances, and thus prepared benzoic ether according to the following formulæ:—

$$C_6H_5Br + CO\left\{\begin{matrix}O,C_2H_5\\Cl\end{matrix}\right. + Na_2 = NaCl + NaBr + C_6H_5,CO_2(C_2H_5).$$

Bromide of ethyl. Chloroxycarbonic ether. Benzoic ether.

Researches on the Propylic Alcohol of Fermentation.—Dr. G. Chaucel.—This lengthy and very concisely written paper, full of formulæ, does not admit of suitable abstraction.

Ethylic Series of Silicium.—MM. Friedel and Ladenburg.—The authors describe in this paper, at great length, their experiments to obtain compounds wherein silicium replaces one or more atoms of carbon. Silicium-ethyl, $Si(C_2H_5)_4$, is a liquid boiling at from 150° to 154°. Silicium-hexethyl, $Si_2(C_2H_5)_6$, is also a liquid, readily inflammable, and giving off, while burning, fumes of silica; vapour density, 7·96.

On Acetochlorhydrine and Octylglycol.—M. de Clermont.—Acetochlorhydrine of octylen is a liquid, insoluble in water, soluble in alcohol, ether, and acetic acid; rather readily inflammable, and burning with green-bordered flame; boiling point, 225°; sp. gr. at 0°, 1·026. Composition, in 100 parts:—C, 58·11; H, 9·20; Cl, 17·19.

Some New Ferrocyanides and Ferricyanides.—M. Wyrouboff.—This paper is chiefly a critical review of the labours of M. Riendel, published in a German periodical some years ago. This author's paper is too lengthy, and too much filled with a large number of formulæ, to admit of useful abstraction.

Analysis of a Native Carbonate of Soda.—M. Joffre.—Composition, in 100 parts:—Soda, 39·41; carbonic acid, 39·58; water, 19·52; sand, 0·53; oxide of iron, 0·01; carbonate of lime, 0·05; chloride of sodium, 0·46; sulphate of soda, 0·44. This salt, therefore, belongs to the mineralogical species known as urao.

Action of Hydrogen upon Acetylen when Platinum Black is simultaneously present.—M. de Wilde.—The author finds that, when acetylen and hydrogen, both chemically pure, are brought together, at the ordinary temperature, in a space wherein platinum-black is placed, hydride of ethyl is formed—

$$\underset{2\text{ vols.}}{C_2H_2} + \underset{4\text{ vols.}}{2H_2} = \underset{2\text{ vols.}}{C_4H_6}.$$

When less hydrogen is applied, it appears, says the author, that ethylen is formed.

Acetic Derivatives from Mannite.—M. Grange.—This paper and the following—

Acetic Derivatives obtained from Amylum Gum and the Hydrocarbonates (MM. Schutzenberger and Naudin), have been already briefly abstracted from the *Comptes Rendus*, a remark which equally applies to—

Butyrate and Valerate of Isopropyl (M. Silva) and—

New Sulphur Acid.—M. Schutzenberger.

Researches on the Ethers of Phenol.—M. Lipmann.—Ethylen-diphenol, obtained by the author by a complicated series of operations, is, when pure, a solid substance, fusing at 95°, insoluble in water, readily soluble in chloroform, and also in boiling alcohol; formula—

$$\left\{\begin{matrix}(C_6H_5)_2\\C_2H_4\end{matrix}\right\}O_2.$$

Ethylen-diphenol sulphuric acid; the lead- and barium-salt of this acid have been studied, the former has the following formula:—

$$\left\{\begin{matrix}(C_6H_4SO_3)_2Pb''\\C_2H_4\end{matrix}\right\}O_2.$$

Tetrabromide of ethylen-diphenol is a solid substance, crystallising in small needles, fusible at a little above 100°. The real constitution of ethylen-diphenyl is, according to this author—

$$C_6H_4CH_2,C_6H_4CH_2.$$

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 12. 1869.

This number contains the report of the meeting of this Society, held under the presidency of Dr. A. W. Hofmann, on the 28th of June last. From the *procès verbal*, we learn that a committee has been formed for the purpose of erecting a simple, yet appropriate, memorial tombstone on the grave of the late Dr. F. F. Runge, who died at Oranienburg, near Berlin, on the 25th of March, 1867. The deceased was well and deservedly known, and well deserved from science and industry this posthumous memorial of services rendered.

The following papers were read:—

Chlorides of Carbon.—M. H. Kolbe.—Through the kindness of Dr. Marquart, the celebrated practical and operative chemist, and owner of chemical works at Bonn, the author has obtained a large quantity of the solid sesquichloride of carbon, C_2Cl_6. (To some of our readers the fact may be of interest to learn that this preparation has been used with comparative success in the worst forms of Asiatic cholera.) This substance is readily converted into the fluid chloride of carbon, C_2Cl_4, by means of the action of zinc and sulphuric acid, although there is simultaneously formed a compound, C_8HCl_9. Since the compound C_2Cl_4 enjoys the property of combining directly with chlorine and bromine, the author thought it might be possible to make that compound enter directly into combination with two atoms of hyponitric acid. This nitro compound, $C_2Cl_4(NO_2)_2$, is prepared when the simple chloride of carbon, C_2Cl_4, is mixed with hyponitric acid, kept very cold by means of cooling mixture, and next heated in a sealed tube at from 110° to 120°. The quantity of dinitro-perchloride of ethylen, or

dinitro-chloride of carbon, thus obtained is rather small in quantity, since, during the preparation, a mass of by-products are formed, among which is chlorocarbonic oxide. The substance alluded to is a solid volatile body, soluble in alcohol and ether, insoluble in water, crystallises like the sesquichloride of carbon, and, like that substance, cannot be reduced to powder. This compound cannot be fused without decomposition. The elementary analysis gave results leading to the formula $C_3Cl_4(NO_2)_2$.

Compound of Ethylen and Nitric Acid.—M. Kekulé.—The author has caused pure nitric acid, and, next, a mixture of nitric and sulphuric acids, to act upon ethylen. In the first instance, a large portion of the ethylen is destroyed by oxidation; but, with great care, and the application of strongly-cooling mixtures, an oily fluid was obtained, on addition of water in small quantity. Large quantities of this oil were obtained when ethylen was made to pass through a mixture of nitric and sulphuric acids, kept cold by means of very cold water. The substance obtained is, after purification, a colourless oily liquid of 1·472 sp. gr.; its vapour attacks the eyes, and causes headache; it is not volatile with decomposition. Far below its boiling point this substance is decomposed, giving off red vapours; even when water is present, the distillation is impossible without the simultaneous formation of nitrous acid, deutoxide of nitrogen, oxalic acid, glycolic acid, and some glyoxylic acid. The same decomposition takes place when this compound is boiled with solutions of alkalies. The author assigns to this body the empirical formula, $C_2H_4N_2O_3$, but he considers it to be an ether of glycol—

$$\left.\begin{matrix} NO \\ \| \\ C_2H_4 \\ NO_2 \end{matrix}\right\} O$$

Phenol-Sulphuric Acid and Nitro-Phenol-Sulphuric Acid.—M. Kekulé.—The author observes that he was the first who pointed out the fact that, when phenol and sulphuric acid act upon each other, there are formed two isomeric sulpho acids, para-phenol-sulphuric acid and meta-phenol-sulphuric acid. Since there have been different experimenters on this subject, some of whom have altogether overlooked this meta acid, and since the author has found that, with different modes of preparation the quantity obtained of this acid varies greatly, he instituted some experiments to ascertain under what conditions either of the two isomeric modifications are chiefly formed. The result obtained is that, when a mixture of phenol and sulphuric acid is left quietly standing at the ordinary temperature, it contains, not only at first, but for weeks after, chiefly the meta acid. When the mixture is heated, the quantity of the para acid increases, and continues to do so until, when the temperature is for some time kept at from 100° to 110°, the para acid only is present in the mixture. When the meta acid, obtained in pure state from its salts, is heated for some time on a water-bath, it is thereby entirely converted into the para acid. As regards the nitro-phenol-sulpho acid, the author found that there does not exist any doubt that, by whatever method this acid is prepared, the product obtained is always identically the same.

Artificial Alizarine.—MM. Graebe and Liebermann.—The authors say the publishing of their French patent on this subject makes it necessary not to delay any further the completion of their brief paper read before this Society, on the 11th of January, on the preparation of alizarine from anthracen. The authors, at the same time, state that, since they reserve their right of publishing full details of experiments and analysis on this topic, they only read a brief, rough, outline sketch. They succeeded in reducing alizarine obtained from madder to anthracen; and, suspecting that alizarine is a chinon acid, the idea of obtaining alizarine artificially became a feasible matter, as may be learned from the following formulæ:—

$C_{14}H_{10}$. Anthracen. $\qquad$ $C_{14}H_6\{(O_2)''(OH)_2$. Alizarine.

The affair rested upon the possibility of substituting in anthracen, for two atoms of hydrogen, the group $(O_2)''$, characterising the chinons; and, for two other atoms of hydrogen, two atoms of hydroxyl. Prof. Anderson, of Glasgow University, discovered that, when anthracen is treated with nitric acid, oxanthracen is formed; this is, according to the authors, the chinon of anthracen (anthrachinon, $C_{14}H_8(O_2)''$). This substance is also obtained from anthracen, by means of other oxidising agents, as, for instance, bichromate of potassa, and sulphuric or acetic acids. The authors tried to introduce into this anthrachinon two atoms of bromine or chlorine, in order to be able, by this means, to obtain the two atoms of the hydroxyl group, which are wanted. Chlorine does not act readily upon anthrachinon; with bromine, the substitution ensues at 100°. When, therefore, anthrachinon is heated for several hours in sealed tubes placed in a water-bath, after addition of four atoms of bromine, it is converted into bibrom-anthrachinon, while hydrobromic acid is simultaneously formed—

$$C_{14}H_8(O_2)'' + 4Br = C_{14}H_6Br_2(O_2)'' + 2BrH.$$

This body is a solid substance, soluble in benzol, crystallising from that solution, or by sublimation, and exhibiting bright yellow-coloured needle-shaped crystals. On being heated with a thoroughly concentrated solution of caustic potassa to about 170° (at which temperature the reaction sets in), the mixture assumes a deep blue colour, and the mass becomes soluble in water, exhibiting thereby the well-known and beautifully violet colour of alizarinate of potassa; when an acid is added to this solution, alizarine is precipitated from it, in the shape of a reddish brown flocculent matter. The following formula exhibits the formation of alizarinate of potassa from bibromide of anthrachinon:—

$$C_{14}H_6Br(O_2)'' + 4KHO = C_{14}H_6(OK)_2(O_2)'' + 2KBr + 2H_2O.$$

The authors next state that they discovered another method for the preparation of bibromide of anthrachinon, and its conversion into alizarine. Since the bibromide of anthracen is converted, by means of being heated along with nitric acid, into anthrachinon, according to this formula:—

$$C_{14}H_8Br_2 + 2NHO_3 = C_{14}H_8(O_2)'' + 2Br + 2NHO_2,$$

the authors suspected that tetrabromanthracen, $C_{14}H_6Br_4$, would be readily converted into bibromide of anthrachinon by the same means. On trying this experimentally, they found that their opinion proved correct. By treating the bibromide of anthrachinon thus obtained with a strong solution of caustic potassa, alizarine was again obtained. The authors positively state that the artificial alizarine thus obtained is in every respect identical with that obtained from madder; this is, be it observed, the first instance of the preparation of a naturally-occuring vegetable colouring matter by artificial means.

Behaviour of the Salts of Silver towards Iodine.—M. Weltzein.—After referring to experiments made by himself in 1854 and 1860, on this subject, the author states:—(1) When iodine acts upon the nitrate of silver, no free oxygen is given off; (2) that, not the anhydride of nitric acid, but hyponitric acid, is obtained, the reaction being represented by—

$$3AgNO_3 + 3I = 3NO_2 + AgIO_3 + 2AgI.$$

The author further says that he hoped to obtain, by the action of iodine upon the acetate and benzoate of silver, the respective anhydrous acids, but failed, and next winds up his paper with a long series of formulæ, not deduced from his own experiments, but made up from theoretical reasoning. The formulæ are too complicated and lengthy to be quoted.

There follows in this number, under the title of Correspondence, letters written from London, from Zürich (Switzerland), and from Cambridge, U.S. M. Meister, secretary of the Chemische Harmonika, a chemical society established at Zürich, writes—"At our meeting on the 22nd of June last, MM. Merz and Weith communicated that, when powdered sulphur is strewed on the surface of boiling aniline, a strong evolution of sulphuretted hydrogen gas is observed, while a base containing sulphur is thereby formed. Other organic substances, as, for instance, acetanilide, glycerine, and naphthaline, are acted upon by sulphur in the same way at a higher temperature. When pure and dry hydrogen gas is made to pass through boiling sulphur, sulphuretted hydrogen gas is developed in large quantities."—Mr. W. Gibbs writes from Cambridge, U.S., communicating the results of some experiments made by him on the—

Action of Nitrites of Alkalies upon Uric Acid and Derivatives therefrom.—When uric acid is heated along with a solution of nitrite of potassa or soda, and sulphuric acid, a strong effervescence takes place, the uric acid is completely dissolved, and the fluid contains alloxan and alloxantin. On evaporation to dryness on a water-bath, parabanic acid is obtained, and very small quantities of two peculiar substances—one a red-coloured, the other a bright bluish fluorescent—both flocculent substances. When acetic acid is applied, instead of a mineral acid, the same phenomena are observed to take place; but the filtered solution deposits a very voluminous salt, which, if nitrite of potassa were applied to the experiment, is composed according to the formula $C_4H_3KN_4O_4$. The peculiar acid contained in this salt has been named stryphninic acid, from στρυφνος, bitter astringent, since the acid and its salts exhibit this taste. The formula of the free acid is $C_4H_4N_4O_4$; it appears to be monobasic, and all its salts, except the lead-salt, are soluble in water. The author read this paper, of which only a brief account is here given, before the National Academy of Sciences, the transactions of which are, we believe, regularly published.

Existence of Molecular Compounds in Gaseous State.—M. A. Naumann.—This paper, which is placed under the section of *Mittheilungen*, and is dated from Giessen, the 1st of July last, is a philosophical essay, and not well suited for abstraction.

We beg to remind our readers that during the months of August and September this periodical is not published.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 199, July, 1869.

The only paper relating to chemistry in this number is on the—

Use of Extracts of Madder in Calico Printing, and the Part each of the Different Pigments contained in Madder Plays in this Operation.—M. Schutzenberger.—The author begins by stating that, notwithstanding the discovery of aniline and other artificially-made colours (dyes), madder and its preparation yet occupy a first rank among dyes, and not only will continue to do so, but its use will become more extended. The author next reviews, at some length, the history of madder, and preparations obtained from it, during the last forty years, alluding to garancine, flowers, or bloom of madder, and commercial alizarine—that is to say, madder submitted to high pressure steam. To M. Kopp is due the discovery of preparing, on the large scale, the pure colouring matter from madder, and, also, of getting purpurine separately therefrom; this substance is very little used, but the alizarine (the chief tinctorial matter contained in madder) is largely used. At Cosmarros, a town in Bohemia, and at Thann, France, the direct application of alizarine, without the use of mordants, has been most successfully applied, especially in the last-named town, by M. Scheurer. The author enters into some purely technical details on this subject, which, however interesting, we leave out, following him rather to the more purely chemical part of his paper. Madder contains:—(1) Alizarine, $C_{60}H_{10}O_8$, a solid substance, readily crystallising, forming orange-coloured needle-shaped crystals by sublimation by heat, soluble in benzol, also in warm alcohol, yielding, with alkalies, a bluish purple-coloured solution. (2) Purpurine, $C_{30}H_{12}O_7$, a solid substance exhibiting red-coloured, needle-

shaped crystals, when crystallised from alcohol, or, also, by sublimation by heat; but by this latter process, a large portion of the substance is decomposed; soluble in benzol, also in warm alcohol, and yields, with alkalies, red-coloured solutions. (3). Pseudo-purpurine, $C_{30}H_{12}O_{9}$, a solid substance, exhibiting, when crystallised from its solution in benzol, small brick red-coloured needle-shaped crystals; is decomposed by heat, yielding purpurine; soluble in benzol, very slightly soluble in alcohol, even at boiling point, and yields, with alkalies, a red-coloured solution. (4). An orange-coloured matter, $C_{20}H_{12}O_{7}+2H_{2}O$, a solid substance, exhibiting, when obtained by the slow evaporation of its alcoholic solution, a crystalline conglomerated mass; is decomposed by heat, yielding purpurine; insoluble in benzol, very soluble in alcohol, and does not yield a solution with alkalies. (5). Purpuro-xanthine, $C_{20}H_{14}O_{8}$ (?), a solid substance, yielding, either by sublimation, or by evaporation of its solutions in alcohol or benzol, yellow-coloured needle-shaped crystals; sublimes by heat; readily soluble in benzol, as well as in alcohol; and yields, with alkalies, a yellow-coloured solution. As regards the formulæ here quoted, the author desires it to be understood that they represent exactly the percentical composition, but that, in a scientific point of view, these formulæ do not express the constitution of the substances; moreover, C=12; H=1; and O=16 in this case. Each of these five substances is fit for use as a dyeing material; but alizarine alone is the dye *par excellence*. It appears, says the author, that the solidity (the fastness or goodness) of the different tints of colours produced by these dyes varies in the inverse ratio of the quantity of oxygen contained in the substance in excess of the hydrogen. Where the quantity of oxygen increases, we come from a more violet red to a bright red, and at last to brick red; and from bright violet colour to a more dirty violet, and, next, to greyish violet. Science has to elucidate practice in many points in respect of madder. No doubt a thorough study of this subject will enable us to find the key to the best mode of so mixing the different bodies to be described, as to produce pigments precisely suited to each peculiar shade of colour required.

Quantity of Copper Produced in the Year 1866 over the Whole World.—M. Petitgand.—The quantity of this metal raised on the entire globe, in the year alluded to, the latest period that statistical records of this kind have been reliably brought together, amounts to 93,415 tons, which is nearly double the quantity raised in 1846. From the statements made by this author, there appears to be an increasing tendency to a lower cost price of this metal. Large and valuable deposits of excellent copper ore known to exist, especially in Polynesia, are as yet untouched.

Moniteur Scientifique, No. 304, August 15, 1869.

This number contains the following original papers and communications:—

Limit of Magnetisation of Iron and Steel.—M. Waltenhofen.—The result of the author's researches on this subject are, that the magnetic moment of the unit of weight of iron may attain a certain limit which is constant and independent of the form and dimensions of the electro-magnet. The absolute value is about 2100 absolute units, expressed in milligrammes. The limit of magnetisation which soft iron can temporarily attain is about five times greater than the permanent magnetism obtained with steel bars, which rarely exceeds 400 units to the milligramme.

Mercury Mines of Almaden.—M. Jouglet.—From this lengthy paper, we learn that mercury, as metal, has been known from the most remote antiquity—that there have been mines worked for mercury ore in Asia Minor in the time of Xenophon; the mines of Almaden, Spain, is yet the largest source of mercury for Europe. The cost of 100 kilos. of the ore is, everything included, only 16 francs and 10 centimes; but it yields, as this author says, by unsuitable management, only 6·9 per cent of mercury, 100 kilos. of which cost, on the spot, 141 francs and 30 centimes; but at Sevilla the price is already 177 francs and 80 centimes, in consequence of cost of transport and the iron vessels in which the metal is carried. The average quantity of mercury produced annually amounts to about 15½ tons, by weight.

Poisoning Caused by Green Tarlatan.—M. Bobierre.—The author says that he obtained from Nantes a sample of this kind of tissue, which, on being tested, was found to contain 10·3 grms. of Schweinfürt green (arsenite of copper) to the square metre, equivalent to 6·03 grms. of arsenious acid. The full dress made of this tissue contained, by weight, no less than 301·4 grms. of arsenite of copper, equivalent to 229 grms. of arsenious acid. At even every slight shaking of the tissue, clouds of a greenish dust came off, which readily explain the poisoning of the party who made the dress. The author tested—1st, by treating the tissue with an alkaline lye, passing chlorine through the solution, and converting the arsenic acid into ammonio-arsenite of magnesia; 2nd, by estimating the quantity of black oxide of copper left after burning the tissue in a red-hot muffle.

NOTES AND QUERIES.

Gas-Works' Residuum.—Can any of your readers give me the name of the most practical work on the conversion of gas-works' residuum.—R. W. JOHNSON.

Utilisation of Waste Vulcanised Rubber.—Would you kindly answer the following question through your Notes and Queries' column?—In large rubber works, how are the waste cuttings, &c., of vulcanised rubber utilised?—D. J. O.

Terra Alba.—"Selenite" desires some information about the artificial sulphate of lime called, in commerce, terra alba. How is it made? by evaporation of sea-water or brine? Where? Why does its quality vary? At what price is it sold? Its uses? To what extent sold? Is it exported largely? To what countries?

Octylic Alcohol.—Can any of your readers kindly inform me as to the best method of preparing octylic alcohol from saponified castor-oil? I cannot find any means of preventing its frothing over on being heated. I have used an apparatus made of tinned iron for distillation, but find, even though the apparatus is 18 inches high, by 3 inches in diameter, and I only put 3 inches of saponified castor-oil and potash into it, that three-fourths of the matter froths over from the lead-off tube. I can nowhere find any instructions for preventing such an occurrence. I have raised the heat gently, but it makes no difference at all.—G. P. CLARKE.

Aniline Colours.—If "Alexis" will have the kindness to state what particular colours he refers to, and the strength in ounces per gallon, I shall be able to furnish him with particulars.—J. W. SLATER.

Aniline Colours.—"Alexis" is referred to Reimann's work on aniline colours, edited by the Editor of this journal. The work contains everything which can be desired, and far more fully and completely than any reply we could give in limited space. The work may be inspected at the Library of the Commissioners of Patents; but it should be in the possession of any one who puts queries as "Alexis" does.

Tungstate of Soda.—M. A. Burn is informed that most salts are bad conductors of heat. As to the price of the tungstate of soda, we could not well give any information, since it would greatly depend upon the quantity required; but why will not alum or borax do, or even common salt, provided it be free from deliquescent salts? All these salts are cheaper than the tungstate, and would render paper fireproof, in the sense of preventing it bursting into flame on being ignited.

Printing Scarlet.—No salts of mercury could be boiled with water in copper, or even iron vessels, without decomposition taking place. If you want to apply the brilliant scarlet colour exhibited by biniodide of mercury, you should apply it by fixing it to the cloth by means of albumen. As far back as the year 1827, it was tried to fix this beautiful pigment by means of mordants, but it did not succeed well. M. Bor, of Amiens, published, in 1842, a method of printing upon cotton a colour resulting from a somewhat complicated process, but, really, the mercury compound you allude to; the printing of this scarlet upon wool and silk does not answer at all. There are various methods of preparing the scarlet biniodide, but for these we must refer you to works on chemistry; however, you could only obtain success by avoiding the use of metallic vessels, and operating in vessels of glass or porcelain. The scarlet of the biniodide of mercury is less beautiful than that of pure vermillion (sulphide of mercury).

Estimation of Phosphates in Manures.—A superphosphate, if properly made, cannot become again insoluble, as long as the superphosphate is acid, which can be readily ascertained by the behaviour of the manure with blue litmus paper, which, when brought into contact with the manure, should turn red; when, however, much iron is contained in a superphosphate (the iron being naturally present in the native phosphate employed in manure making), then it may happen that a basic phosphate of iron is formed by the action of the air—and this may constitute the so-called "reduced" phosphate. No makers of superphosphate will use more sulphuric acid than is precisely required: it would be a loss to them. One equivalent of bone-ash requires two equivalents of sulphuric acid; or, in other words, 155 parts of tribasic phosphate of lime require 98 parts of concentrated sulphuric acid, for being converted into superphosphate of lime. Most, if not all, of the manufacturers of superphosphates are men who conduct their business with conscientious care and upon scientific principles, well knowing beforehand the materials they have to deal with, so as to ensure efficiency of the produce without excess of labour or materials.—CHEMICUS.

TO CORRESPONDENTS.

*** The STUDENTS' NUMBER of the CHEMICAL NEWS will be published on Friday, September 17th. Gentlemen holding official positions in the Universities, Medical Schools, &c., of the United Kingdom, where Chemistry and Physical Science form a part of the Education, who have not yet forwarded the necessary information to our office for publication in that number, will confer a favour by sending it with the least possible delay.

Bichromc.—Your letter involves a legal question; we would rather not offer any advice on the subject.

Walter Weldon.—In reporting a paper by this correspondent in our last issue, he was styled "F.C.S." He has written to ask us to correct this error, as he is not yet a Fellow of the Chemical Society.

E. B.—("Explosion Caused by Ammonia Gas.") In the original paper it reads exactly as printed in our issue of the 3rd inst: we believe, however, it is a typographical error in the German paper, and we intended to have made a remark to this effect in our abstract, as we are well aware that no iron vessel of the dimensions specified would stand such an enormous pressure; we venture the explanation that the total force exerted at the time of the explosion was 20,000 pounds, not on the square inch, but over the entire surface of the vessel. On inspection of other German periodicals we find that they also have reproduced this error. The vessel was made of wrought-iron.

THE CHEMICAL NEWS.

Vol. XX. No. 512.

(STUDENTS' NUMBER.)

SCHOOLS OF CHEMISTRY.

EXAMINING BOARDS.

UNIVERSITY OF LONDON.

Candidates for any Degree granted by this University are required to have passed the Matriculation Examination, to which no candidate is admitted unless he has produced a certificate showing that he has completed his sixteenth year.

The Fee for this Examination is £2.

The Examination includes the following subjects:—

Natural Philosophy.*

Mechanics—

Composition and Resolution of Statical Forces.

Simple Machines (*Mechanical Powers*):—Ratio of the Power to the Weight in each.

Centre of Gravity.

General Laws of Motion, with the chief Experiments by which they may be illustrated.

Law of the Motion of Falling Bodies.

Hydrostatics, Hydraulics, and Pneumatics—

Pressure of Liquids and Gases, its equal diffusion, and variation with the depth.

Specific Gravity, and modes of determining it.

The Barometer, the Syphon, the Common Pump and Forcing-Pump, and the Air-Pump.

Acoustics—

Nature of Sound.

Mode and rate of Propagation of Sound.

Musical Tones.

Optics—

Laws of Reflection and Refraction.

Formation of Images by Simple Lenses.

Chemistry.

Heat—its sources. Expansion. Thermometers—relations between different Scales in common use. Difference between Temperature and Quantity of Heat. Specific and Latent Heat. Calorimeters. Liquefaction. Ebullition. Evaporation. Conduction. Convection. Radiation.

Chemistry of the Non-Metallic elements; including their compounds as enumerated below—their chief physical and chemical characters—their preparation—and their characteristic tests.

Oxygen, Hydrogen, Carbon, Nitrogen. Chlorine, Bromine, Iodine, Fluorine. Sulphur, Phosphorus, Silicon.

Combining Proportions by weight and by volume. General nature of Acids, Bases, and Salts. Symbols and Nomenclature.

The Atmosphere—its constitution; effects of Animal and Vegetable Life upon its composition.

Combustion. Structure and Properties of Flame. Nature and composition of ordinary Fuel.

Water. Chemical peculiarities of Natural Waters, such as rain-water, river-water, spring-water, sea-water.

Carbonic Acid. Carbonic Oxide. Oxides and Acids of Nitrogen. Ammonia. Olefiant Gas, Marsh Gas, Sulphurous and Sulphuric Acids, Sulphuretted Hydrogen.

Hydrochloric Acid. Phosphoric Acid and Phosphuretted Hydrogen. Silica.

* The knowledge required of these subjects in Natural Philosophy is such as may be attained by attending a course of experimental lectures.

Bachelor of Science (B.Sc.).

This Degree is conferred on candidates who pass a satisfactory examination in Mathematics, Mechanical and Natural Philosophy, Botany and Vegetable Physiology, Zoology, and Chemistry.

First B.Sc. Examination.

No Candidate (with the exception of such as have obtained Honours at the Matriculation Examination in the preceding January) is admitted to this examination within one academical year of the time of his passing the Matriculation Examination.

The Fee for this Examination is £5.

The examination is conducted by means of printed papers; but the Examiners are not precluded from putting, for the purpose of ascertaining the competence of the Candidates to pass, *viva voce* questions to any Candidate in the subjects in which they are appointed to examine.

The First Examination includes the following subjects:—

Natural Philosophy.

Heat—

Sources of Heat; conduction—convection.

Effects of Heat; expansion generally—of water—of gases and vapours; liquefaction; vaporisation; latent heat; expansive force of steam; dew-point; gases and vapours compared.

Specific Heat.

Thermometers; Pyrometers.

Heat in the Radiant state.

Electricity.

Sources of Electricity.

Static Electricity; dual character—insulation—induction—specific inductive capacity—equivalent antithetic states—disruptive discharge—convection; Electroscopes—Leyden Jar, &c.

Dynamic Electricity; Conduction—the electric current—derived currents—induction of currents; Voltaic Pile and other voltaic arrangements.

Thermo-Electricity; Electro-Thermometer.

Magnetism—

Magnets, the Earth, &c.; Induction—communication—retention—Magnetic relations of iron, steel, &c.

Electro-Magnetism—as in the spark—in conducting media—in soft iron; Magneto-Electricity; principle of Electro-magnetic and Magneto-electric machines.

Terrestrial Magnetism.

Inorganic Chemistry.

Matter; simple and compound.

Elementary bodies classed. Metallic and Non-Metallic bodies.

Chemical Combination and Mechanical Mixture. Solution.

Outlines of Crystallography. Isomorphism. Dimorphism. Allotropic conditions of matter. Chemical Affinity. Laws of Combination by weight and by volume, as deduced from the history of the individual elements. Equivalent Numbers. Equivalent Volumes. Symbolical Notation, including questions on the Unitary System. Formulæ. Nomenclature.

Chemical actions produced under the influence of Heat. Nature of Combustion. Structure and properties of Flame. Principles of Illumination. Chemical action of Light. Photography.

Oxygen. Ozone.

Hydrogen. Water.

Nitrogen. Chemical constitution of the Atmosphere. Diffusion of Gases. The Oxides of Nitrogen; Nitric Acid. Ammonia.

Chlorine, Bromine, and Iodine. Their compounds with Oxygen and Hydrogen. Theory of Bleaching.

Fluorine and Hydrofluoric Acid.

Sulphur. Sulphurous Acid. Manufacture and Chemical applications of Sulphuric Acid. Other Oxygen compounds of Sulphur. Sulphuretted Hydrogen.

Phosphorus. Oxygen and Hydrogen compounds of Phosphorus. Theory of Acids. Monobasic, Dibasic, and Tribasic Acids.

Carbon. Carbonic Oxide and Carbonic Acid. The principal Hydrogen compounds of Carbon. Manufacture of Coal Gas.

Silicon and Boron. Their compounds with the elements previously enumerated.

Metals. Characters of Metals as a class. Metallurgical Processes. Alloys. Classification of the Metals.

Potassium. Nitre. Gunpowder. Theory of the action of Gunpowder.

Sodium. Manufacture of Carbonate of Soda.

Barium. Strontium. Calcium. Mortars. Cements.

Magnesium. Aluminium. Glass. Porcelain.

Manganese. Iron. Composition and properties of Cast-Iron, Wrought-Iron, and Steel. Chromium.

Cobalt. Nickel. Zinc. Cadmium.

Lead. Manufacture of White-Lead.

Copper. Mercury. Bismuth. Tin. Arsenic. Antimony.

Silver. Gold. Platinum.

Principal compounds of the Metals with the Non-Metallic elements. Theory of Salts.

Principles of Mineral Analysis.

Principles of Electro-Chemistry.

For the First Examination, a knowlege of Inorganic Chemistry only is necessary.

Examination for Honours.

Candidates for Honours in Chemistry are examined in any of the following subjects, at the option of the Examiners:—

Elementary Substances and their combinations.

Electro-Chemistry.

Radiant Chemical Action.

In the Examination for Honours, the Candidate, being not more than twenty-two years of age, who most distinguishes himself in Chemistry and Natural Philosophy, will receive an Exhibition of Forty pounds per annum for the next two years.

Second B.Sc. Examination.

Candidates for this Examination who have not previously taken the Degree of B.A. shall be required either to have passed the First B.Sc. Examination at least one Academical year previously, or to have passed the First M.B. Examination, in this University.

The Fee for this Examination is £5.

This Examination embraces Organic Chemistry, including the following subjects:—

Ultimate analysis of Organic bodies. Calculation of Empirical Formulæ. Methods of controlling Empirical Formulæ. Determination of the Equivalents of organic acids and bases; examination of products of Decomposition; determination of the Vapour-density of volatile bodies.

Law of Substitution. Compound Radicals. Homologous Series.

The Chemical history of the Cyanogen group. Cyanogen. Hydrocyanic Acid. Cyanic Acid and Urea. Fulminates. Cyanuric Acid. Sulphocyanic Acid. Chlorides of Cyanogen. Uric Acid.

Amylaceous and Saccharine substances. Fermentation. Alcohol, Wine, Beer, Bread, &c.

Homologues of Alcohol. Ethers, simple and mixed. Oxidation of Alcohol. Aldehyd and Acetic Acid, and their homologues. Anhydrides, simple and mixed. Compound Ethers.

Diatomic Alcohols and their Acids, Glycol and Oxalic Acid and their homologues.

Triatomic Alcohols. Glycerine. Fatty and Oily bodies. Saponification.

Vegetable Acids;—the principal.

Ammonia and its derivatives. Ammonium and Ammoniacal Salts. Amides and Amines; their Classification. The chief natural Organic Bases.

Colouring Matters. Indigo and its derivatives. Principles of Dyeing.

The chief constituents of the Vegetable organism. Cellulose. Vegetable Fibrin. Albumin, Casein, Glutin, &c.

The chief constituents of the Animal organism. Animal Fibrin, Albumin, Casein, Gelatin. Blood, Milk, Bile, Urine, &c.

Decay, Putrefaction. Destructive Distillation.

The Chemical principles of the process of Nutrition and of Respiration in Plants and Animals.

Examination for Honours.

The Candidate, not more than twenty-three years of age, who, in the Examination for Honours, most distinguishes himself in Chemistry, will receive Fifty pounds per annum for the next two years, with the title of University Scholar.

Doctor of Science (D.Sc.).

No Candidate is admitted to the Examination for the Degree of D.Sc. until after the expiration of two Academical years from the time of his obtaining the Degree of B.Sc. in this University.

Candidates for the Degree of D.Sc., in any year, must give notice of their intention to the Registrar, and pay to him a Fee of Ten pounds, on or before the 1st of April.

Chemical Candidates can be examined either in Inorganic or Organic Chemistry; but no Candidate will be approved by the Examiners unless he has shown a thorough practical knowledge* of the *Principal Subject*, and a general acquaintance with the *Subsidiary Subject*, or *Subjects*, specified as belonging to the Branch so selected.

Inorganic Chemistry.

Principal Subject—Inorganic Chemistry.

Subsidiary Subjects—Either Organic Chemistry; or, Mineralogy, Crystallography, and Chemical Technology in its relations to Inorganic Chemistry.

Organic Chemistry.

Principal Subject—Organic Chemistry.

Subsidiary Subjects—Either Inorganic Chemistry; or, Chemical Technology, in its relations to Organic Chemistry, and the Chemistry of Animal and Vegetable Life.

EXAMINATIONS IN CONNECTION WITH THE DEPARTMENT OF SCIENCE AND ART, SOUTH KENSINGTON.

A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom.

This sum is administered by the Science and Art Department.

The object of the grant is to promote instruction in Science, especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

The following are among the Sciences towards instruction in which aid is given:—Acoustics, Light, Heat, Magnetism, and Electricity, Inorganic Chemistry, Organic Chemistry, Geology, Mineralogy, Mining, Metallurgy.

The assistance granted by the Science and Art Department is in the form of—1. Public Examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions. 2. Payments on results to teachers. 3. Scholarships and Exhibitions. 4. Building Grants. 5. Grants towards the purchase of apparatus, &c.

* It must be understood that the Candidate for the Degree of D.Sc. is expected to be so fully conversant with the Principal Subject he may select, as to be able to go through any examinational test (whether theoretical or practical) of his acquirements in it that can be fairly applied.

Examinations in all the before-mentioned Sciences are held annually about May, through the agency of the Local Committee (which must consist of not less than five well-known responsible persons) in any place in the United Kingdom which complies with the requisite conditions. The Examinations are of two kinds, but held on the same evening and conducted by the same committee. *a*. The class examinations for students under instruction in Science Classes, whether taught by teachers qualified to earn payments on results or not. *b*. The honours examinations, of a highly advanced character.

The class examination is of two grades or stages; the first stage or elementary examination, and the second stage or advanced examination.

Application for examination must be made before the end of March, stating the number of persons and the subject or subjects in which they are to be examined.

At the May class examinations the grades of success are:—in the first stage or elementary paper, first, second, and third class; and in the second stage or advanced paper, first and second class. For the third or lowest class the standard of attainment is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it. The standard may be raised from year to year.

To all successful students are given printed lists of results showing their position. To the first class in both stages Queen's Prizes are given, consisting of Books or Instruments' chosen by the Candidates from lists furnished for that purpose.

Four medals, one gold—one silver, and two bronze—are given in each subject for competition among the *bona fide* students of Science Classes who either come within the category of persons on account of whom payments can be earned, or who are under seventeen years of age. The Payments on results are made either directly to teachers or to the committee or managers of the school. Persons are qualified to earn payments who have—(*a*) obtained certificates as teachers in any of the before-mentioned sciences according to the rules in force previous to January, 1867; or (*b*) obtained a First or Second Class at the May examination since that date; or (*c*) who have taken honours at the May examination.

No payments are made to a teacher on account of instruction given in subjects in which he is not so qualified.

The student must have received 25 lessons at least from the teacher or teachers in each subject in which payment is claimed since the last examination, each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day.

There are two Scholarships provided—the Elementary School and the Science and Art Scholarships. In both cases the scholar must be from 12 to 16 years of age and must have passed in a branch of science at the May examination.

Building Grants for New Schools may be made at a rate not exceeding 2s. 6d. per square foot of internal area, up to a maximum of £500 for any one school, under certain conditions.

A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent on the cost of them, is made to Science Schools and Classes in Mechanics' and similar institutions with a properly constituted committee.

Science teachers who have taught two years consecutively, and passed not less than thirty students each year, are allowed second class railway fare and £3 towards their expenses while living in London for the purpose of visiting the South Kensington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools, on condition that they remain there five days at least.

CHEMICAL LECTURES.

UNIVERSITY COLLEGE.

WINTER TERM (Oct. 4 to March 31).

Chemistry.—Professor Williamson, Ph.D., F.R.S.

Lectures daily, except Saturday, from 11 to 12 a.m.

Exercises on Tuesdays, Wednesdays, Thursdays, and Fridays, from 9 to 10 a.m.

Fee for the Whole Course of Lectures, £6 6s.; for a Half Course, £3 3s.; Perpetual, £9 9s.; for the Organic Course alone, £2 2s.

Fee for the Exercise-Class—for the Course, £2 2s.; for the Half Course, £1 1s.

The Instruction in this Class is of two kinds, consisting partly of Experimental Lectures by the Professor, partly of Exercises and personal instruction on the subject of the Lectures by Tutors, under the direction of the Professor.

Students cannot profit duly by attendance on the Lectures unless they work at the subject of each Lecture so as to make it their own.

Attendance on the Tutorial part of the Class enables Students to do their work more effectually and rapidly than they can do it by themselves.

The First Half of the Course to Christmas includes those parts of Chemistry which are required for the Matriculation Examination of the University of London.

The following order of subjects is adopted in it:—

Heat.—Instruments for measuring Temperature. Decompositions produced by Heat. Expansion. Tension of Vapours. Conduction. Convection. Calorimeters. Specific Heat. Latent Heat. Evolution of Heat by Chemical Action, and by Mechanical Action. Mechanical equivalent of Heat.

Light.—Photometry. Refraction and Dispersion of Light. Study of Spectrum. Heat Rays. Chemical Rays. Construction of common Optical Instruments. Double Refraction. Polarisation. Chemical applications of Phenomena of Polarisation. Combinations and Decompositions produced by Light and Actinic Rays. Photography.

Electricity and Magnetism.—Simple Magnetic Instruments. Magnetic and Diamagnetic Bodies. Electrical Machine, Electrophorous, &c. Positive and Negative Electricity. Electrometers. Conduction. Induction. Leyden-jars, &c. Discovery of Galvanism. Various forms of Battery. Study of the Chemical Action of Galvanic Batteries. Galvanometers. Heating Effects of Battery in relation to Chemical Action. Thermo-Electricity. Rheostat, &c.

Oxygen.—Theory of Combustion. Hydrogen. Nitrogen. Composition and chief changes of the Atmosphere. Carbon, Chlorine, Bromine, Iodine, and Fluorine. Sulphur, &c. Phosphorus. Boron. Silicon.

The chief compounds of these non-metallic elements among themselves are studied in relation to their production, properties, and decompositions. The proportions by weight and by volume in which they combine are explained and illustrated in connection with the atomic theory.

The Second Half of the Course, extending from January to March, includes the following subjects:—

I. Preparation and properties of the chief metals, including their characteristic reactions and most important salts. Detection of Metallic Poisons. Quantitative Estimation of Metals. Principles of Classification. Monatomic, Diatomic Metals, &c.

A weekly *vivâ voce* examination is held during the First Half Course and the commencement of the Second Half Course.

II. *Organic Chemistry*.

This commences in the second week in February, and occupies five Lectures weekly till about the end of March. It includes a study of the characteristics and metamorphoses of the chief organic acids, bases, alcohols, ethers,

colouring-matters, &c. Methods of ultimate and proximate analysis. Determination of molecular weights. Theory of types; of compound radicals. Phenomena of ermentation, &c.

Practical Chemistry.

Mondays, Tuesdays, Thursdays, and Fridays, from 12 to 1.

The Course consists of about Forty Lessons, the first twenty being given in the five weeks preceding the Christmas Vacation, the remainder immediately after it.

The First Half includes the portion of Chemistry required for the Matriculation Examination.

For particulars, see the Prospectus of the Summer Session.

Fee for the Course, £4 4s.; Half Course, £2 12s. 6d.

SUMMER SESSION (May 2 to July 23)

Practical Chemistry.—Professor Williamson, Ph.D., F.R.S.

I. *Elementary Course.*

About Forty Lessons, of one hour each, on Tuesday, Wednesday, Thursday, and Friday, from 11 to 12, commencing in the first week of May. Students are taught the construction and use of apparatus for the preparation of the most important gases, acids, &c. The characteristic tests for the presence of the common acids and bases, including the chief metallic and other poisons. Also the processes for separating these bodies from one another.

Solutions are frequently given in the class for investigation.

The first six weeks of the Course are occupied by the study of the chief non-metallic elements, and their simple compounds. Metallic salts, &c., are subsequently studied.

Fee for the Course, £4 4s., including cost of materials and apparatus.

II. *Senior Course.*

About Ten Lessons, of two hours each, on Mondays, from 10 to 12, commencing in the first week in May. The Course includes tests for fixed and volatile organic acids, nitrogenised acids, sugars, glycerine, &c.; organic bases and alkaloids, constituents of blood, milk, urine, &c.

Volumetric methods of quantitative analysis of acids, alkalies, urea, prussic acid, iron, &c., are practised.

Fee for the Course, £2 2s., including cost of materials and apparatus.

III. *Summer Matriculation Course.*

Professor Williamson, F.R.S., assisted by Mr. F. S. Barff, M.A., F.C.S.

This Course includes those parts of Chemistry which are required for the Matriculation Examination of the University of London.

The Course consists of about Twenty Lessons in Practical Chemistry, and of an equal number of Oral Lessons. The Practical Lessons include the preparation of the common gases and acids, &c., and the study of their characteristic properties in relation to the elementary laws of combination.

The other lessons are chiefly devoted to those parts of the subject which require fuller oral explanation than is given in the practical lessons. They include numerous exercises and questions, to which answers in writing are given by the Students. These Lessons will begin on Wednesday, April 6th, at 11 a.m.

The Class will meet on the first five week days, from 11 to 12; and some other Meetings will be announced when the Class has assembled.

Fee for the Class, £4 4s., including cost of materials and apparatus.

Analytical and Practical Chemistry.

BIRKBECK LABORATORY.

The instruction in the Laboratory is intended for beginners as well as for more advanced students. It includes practice in the construction and use of apparatus for preparing the common gases, acids, bases, salts, &c. study of the qualitative methods of detecting and separating mineral or organic bodies from one another; also quantitative analysis in the wet way, organic analyses, vapour-densities, &c.; instruction in gas analysis.

More advanced students are instructed in the methods of original research, especially in organic chemistry.

When accompanied or preceded by attendance on the Lectures on Chemistry, the Laboratory Course qualifies Students in the application of Chemistry to the Manufacturing Arts, Metallurgy, Medicine, or Agriculture, &c. Instruction is given in the principles and processes of Gas Analysis.

The Laboratory and Offices are fitted up completely with the most improved apparatus and utensils for experimental research, both for beginners and for advanced Students. They are open daily, from 9 a.m. to 4 p.m., from the 4th of October until the end of July, with a short recess at Christmas and at Easter. Saturday, from 9 to 2.

Fees for the Session, 25 guineas; six months, 18 guineas; three months, 10 guineas; one month, 4 guineas; exclusive of the expense of materials. A deduction of about 40 per cent is made for Students who can attend only three fixed days per week.

A Gold Medal and Certificates of Honour are competed for by Students entered for the Session.

EVENING CLASSES.

The Session is divided into three Terms, each of ten complete weeks, exclusive of vacations—

I. The Michaelmas Term, beginning on Monday, the 11th of October, and ending on Thursday, December 16th.

II. The Lent Term, beginning on Monday, the 10th of January, and ending on Thursday, March 17th.

III. The Summer Term, beginning on Monday, the 21st of March, and ending on Thursday, June 9th, the Easter Vacation extending from the 14th to the 25th of April, both days inclusive.

The object of these Classes is to extend the benefits of the College Tuition especially to gentlemen engaged elsewhere during the day, and to provide Instruction in subjects not taught in the ordinary College Classes.

The Beadles have orders to admit gentlemen to any of the Classes, with the permission of the Professor or Teacher, as occasional visitors.

The Library is open for the convenience of the Students between 6.30 and 8.30 on the evenings when the Classes meet, except when it is wanted for other purposes.

Elementary Chemistry—Theoretical and Practical.

Professor Williamson, F.R.S., and Mr. Jones. Monday, from 7.30 to 9.30.

A Course of Twenty Lessons, of two hours each, in the Michaelmas and Lent Terms.

The elements of Chemistry are explained to the Class, and the experiments illustrating the subject are performed by the Students.

The subject will be the common Non-Metallic Elements and the common Metals, their Compounds and chief Properties, and the best methods of distinguishing and separating them.

All the experiments and analyses are repeated by each Student, or by not more than two Students jointly.

Fee, including the cost of materials, &c., £2 2s. per Term.

ROYAL SCHOOL OF MINES AND COLLEGE OF CHEMISTRY.

Professor of Chemistry.—Dr. E. Frankland, F.R.S.

The instruction in Chemical Science embraces:—

1. A Course of Lectures on Experimental Chemistry with special reference to the applications of Chemistry in the Arts and Manufactures.

2 A systematic Laboratory Course for the Practice of Chemical Analysis.

Chemical Lectures.—The Course consists of Forty Lectures on Mineral Chemistry and Thirty Lectures on Organic Chemistry.

The Lectures are delivered at the Royal College of Chemistry, Oxford Street.

Chemical Laboratory.—The general Laboratory for instruction in chemical manipulation, in qualitative and quantitative analysis, and in the method of performing chemical researches, is under the direction of Dr. Frankland. The Royal College of Chemistry having become the property of the Government, its Laboratories are used for the instruction of the pupils of the Royal School of Mines.

There are three terms in the collegiate year, of three months each, commencing in the first week of October, January, and April respectively. The Laboratory hours are from 10 a.m. to 5 p.m., with the exception of Saturdays, when the Laboratory closes at 2 o'clock.

Each Laboratory Student works independently, there being no classes. All operations are superintended by the Professor and his assistants. A table with drawers, cupboards, and shelves, is appropriated to every pupil. The Institution supplies gas, fuel, and reagents. The larger and more expensive instruments of the Laboratory, such as air-pumps, thermometers, barometers, condensers, &c., may be used by the students, who are held responsible for their safety. The students have to provide themselves only with the apparatus specified in the Laboratory regulations. More advanced students engaged in private researches have to supply themselves with such materials as are not included amongst the ordinary reagents of the Laboratory.

Professor of Metallurgy.—Dr. Percy, F.R.S.

The course of instruction in Metallurgy consists of Lectures and Laboratory practice.

The object of the Lectures is the communication of such instruction as the student may be able to apply to the greatest practical advantage, when he may be subsequently engaged in conducting any metallurgical process.

Metallurgical Laboratory.—This Laboratory is conducted by Mr. R. Smith, under the direction of Dr. Percy, and is devoted to practical instruction in Metallurgy. The nature of this instruction will be adapted to the special requirements of the Students. It comprises:—Assaying in all its branches, especially of the more important metals, such as iron, copper, lead, tin, alloys of silver and gold, &c.; and the examination of ores and metallurgical products.

The ability of the student to make trustworthy assays is in every case thoroughly tested; and no certificate of competency is given to a student who has not furnished satisfactory proof that he is able to obtain accurate results.

There are three terms in the collegiate year, of three months each. The Laboratory hours are from 10 to 4 during November, December, January, and February; and from 10 to 5 during the other months, with the exception of Saturdays, when the Laboratory is closed.

The charge for instruction in the Metallurgical Laboratory is £15 for three months; £12 for two months; and £7 for one month.

Lectures to Working Men.—Short courses of lectures at suitable periods of the year are given in the evening to Working Men. These courses are systematic, and arranged so as to illustrate, within the period of two years, the principal subjects taught at the Institution. Those for the ensuing Session include:—Chemistry, Physics, Applied Mechanics, Metallurgy.

KING'S COLLEGE.

Professor of Chemistry—W. A. Miller, M.D. V.P.R.S.

Professor of Practical Chemistry—C. L. Bloxam.

Students of the first and second years are admitted to the Course of Theoretical and Applied Chemistry. The Course commences with a view of the forces which concur to the production of Chemical Phenomena, after which the laws of Chemical Attraction are discussed, and the Non-metallic Elements and their principal Compounds are described,

The metals and their principal compounds are next examined, care being taken to point out the applications of the Science to the Arts, and the processes of the different Manufactures of Metallurgy, and of Domestic Economy, are explained and illustrated.

Examinations of the Class, both *viva voce* and by written papers, are held at intervals during the course at the usual Lecture hour. Dr. Miller has published a work on Chemistry, which is used as a text-book by the class.

Third Year.—Students who have completed six Terms in this Department are admitted to a Course of "Practical Chemistry," consisting of Twelve Demonstrations in each term; and they go through a course of Manipulation in the most important operations of Chemistry, including the first steps of Analysis.

Any Student of this department may be admitted to this Class at any period of his study, on payment of an extra fee.

Experimental and Analytical Chemistry in the Laboratory.—The object of this Class is to afford to Students who are desirous of acquiring a knowledge of analysis, or of prosecuting original research, an opportunity of doing so under the superintendence of the Professor and Demonstrator; Students may enter, upon payment of the extra fees, at any time except during the vacation, and for a period of one, three, six or nine months, as may best suit their convenience. The laboratory hours are from ten till four daily, except Saturday, on which day the hours are from ten till one.

In addition to the Laboratory fee, each Student defrays the expenses of his own Experiments. The amount of this expense, which is comparatively trifling, is entirely under his own control.

Analytical and Experimental Chemistry.—Besides the Course of Chemical Lectures and the Summer Class of Practical Chemistry, provision is made for those Students who wish to become more minutely acquainted with the practical details of the science. By means of this Class each Student is enabled to familiarise himself with the methods of analysis and research. After passing through a preliminary course of analytical operations, each Student devotes himself to such portions of the science as are most interesting to himself, or most likely to be practically useful to him. The Daniell Scholarship of £20, tenable for two years, is given every alternate year for original research in the Laboratory.

The Fees for admission to the Laboratory Class, exclusive of materials, are, for one month, £4 4s.; for three months, £10 10s.; for six months, £18 18s., &c.

EVENING CLASSES.

Classes for Evening Instruction are held at King's College from October to March, and during April, May, and June.

The Classes include one for the Elements of Chemistry and one for Practical Chemistry.

The fee for the former is £1 11s. 6d.; for the latter £2 2s. The Classes meet twice a week.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

17, BLOOMSBURY SQUARE, W.C.

School of Pharmacy. The session (1869-70) will commence on Friday, October 1st, and extend to the end of July.

LECTURES ON CHEMISTRY AND PHARMACY, BY DR. REDWOOD.

These Lectures will be delivered on Monday, Tuesday, and Wednesday mornings, at 9 o'clock, commencing on Monday, October 4th.

Part 1.—Physics in relation to Chemistry and Pharmacy.
,, 2.—Chemistry of Inorganic Bodies.
,, 3.—Chemistry of Organic Bodies.

Also Lectures on Botany and Materia Medica, by Professor Bentley. The first and second parts of this course,

extending over the winter months, will be delivered at 17, Bloomsbury Square, on Friday and Saturday mornings, at 9 a.m., commencing on Friday, October 1st. The third part of the course, on Systematic Botany, will be delivered at the Royal Botanic Gardens, Regent's Park, at 8 a.m.

Fees.—For registered apprentices and associates of the Society' for either of the above courses, £1 1s.; for either part separately, 10s. 6d. For those not connected with the Society, £2 2s. for either of the above courses; £1 1s. for either part separately. Students have free admission to the Library and Museum.

Laboratory.—The suite of Laboratories for Practical Instruction in General and Pharmaceutical Chemistry will be opened on Friday, the 1st of October, under the direction of Professor Attfield, Ph.D. Fee for the entire session of ten months, Twenty-five Guineas. The Laboratories are open from 9.30 a.m. till 5 p.m. Students can enter at any period during the session.

Two Scholarships (the Jacob Bell Memorial Scholarship) of Thirty Pounds a year each, are open to competition annually in July.

The Board of Examiners meet monthly, and are required by the Pharmacy Act to examine "all candidates who may present themselves for examination in their knowledge of the Latin Language, in Botany, in Materia Medica, in Pharmaceutical and General Chemistry, and to grant Certificates of Competency.

CITY OF LONDON COLLEGE, LEADENHALL STREET, E.C.

The Annual Courses consist of three terms, each averaging ten experimental lectures; fee, 5s. per term. Subjects:—Junior Class, Chemistry—first year, Non-Metals; second year, Metals and (time permitting) Elements of Organic Chemistry. Senior class, 7 to 8 p.m., Practical Analysis.

LADIES' MEDICAL COLLEGE, FITZROY SQUARE.

The Course of Lectures on Elementary Chemistry, by Mr. John Newlands, F.C.S., will commence on Tuesday, October 5th, at 4 p.m., and be continued on successive Tuesdays at the same hour. Ladies will be admitted to the first lecture on presenting their cards at the College. Further particulars may be obtained on application to the Lady Secretary, at 4, Fitzroy Square.

BIRKBECK LITERARY AND SCIENTIFIC INSTITUTION.

EVENING CLASSES.

Chemistry.—Mr. G. Chaloner. Tuesday, 8 to 9.

NEW KENNINGTON INSTITUTE.

Evening Lectures and Practical Classes in Chemistry, under the direction of Dr. Muter.

POLYTECHNIC INSTITUTION.

Course of Thirty Lessons in Inorganic Chemistry, by Mr. G. F. Downar, under the superintendence of Professor Pepper. Tuesday, 8.30 to 10 p.m.

ROYAL VETERINARY COLLEGE, CAMDEN TOWN.

Chemical Professor.—Mr. R. V. Tuson.

LECTURES AT LONDON MEDICAL SCHOOLS.

ST. BARTHOLOMEW'S HOSPITAL & MEDICAL COLLEGE.

WINTER SESSION.

Lecturers.—William Odling, M.B. Lond., F.R.S., Fellow of the Royal College of Physicians, Fullerian Professor of Chemistry at the Royal Institution, and Dr. Matthiessen, F.R.S. Monday, Wednesday, and Friday, at 10 a.m. One course, £5 5s.

SUMMER SESSION.

Practical Chemistry.—Dr. Matthiessen, F.R.S. One course, £2 2s.

CHARING CROSS HOSPITAL AND COLLEGE.

WINTER SESSION.

Lecturer.—Mr. C. W. Heaton, F.C.S. Monday, Wednesday, and Friday, at 10. One session, £5 5s.

The Laboratory is open daily.

SUMMER SESSION.

Practical Chemistry.—Mr. Heaton, F.C.S. Monday, Wednesday, and Friday. One session, £2 2s.

ST. GEORGE'S HOSPITAL.

WINTER SESSION.

Lecturer.—Dr. H. M. Noad, F.R.S. Tuesday, Thursday, and Saturday, at 11.30. One course, £6 6s.

SUMMER SESSION.

Practical Chemistry.—Dr. Noad, F.R.S. Daily, at 10. One course, including the use of apparatus and materials, £4 4s.

GUY'S HOSPITAL.

WINTER SESSION.

Lecturer.—Dr. Alfred Taylor. Tuesday, Thursday, and Saturday, at 11. One course, £4 4s.

SUMMER SESSION.

Practical Chemistry.—Dr. Stevenson. Monday, Wednesday, and Friday, from 10 to 1. One course, £4 4s.

LONDON HOSPITAL.

Introductory Lecture on October 1st by C. Meymott Tidy, M.B., C.M., F.C.S., Lecturer on Chemistry at the Medical College.

Lecturers on Chemistry.—Henry Letheby, M.B., and C. Meymott Tidy, M.B.

The subjects of this course are Physics in their relation to Chemistry and Chemistry Proper. They are alternately made the chief subjects of the course, so that pupils who are studying for the Universities, may, in the period of two Winter Sessions, obtain a full course of Lectures on each subject.

The Lectures are delivered on Monday, Wednesday, and Friday, at 10·30 a.m.

Dr. Tidy has special classes for those reading for the Universities.

Practical Chemistry.—During the Summer Session, Dr. C. Meymott Tidy will deliver a short course of Lectures on Acoustics, in connection with a course on Diseases of the Ear, by Mr. Walter Rivington, M.S., Senior Assistant Surgeon, Lecturer on Anatomy, and Dean.

ST. MARY'S HOSPITAL.

WINTER SESSION.

Lecturer.—Dr. W. J. Russell, F.C.S. Monday, Tuesday, Thursday, and Friday, at 10.15. £5 5s.

SUMMER SESSION.

Practical Chemistry.—Dr. W. J. Russell, F.C.S. Tuesday and Thursday, at 11.30 a.m.; and Saturday, at 9 a.m. One session, £3 3s.

MIDDLESEX HOSPITAL.

WINTER SESSION.

Lecturers.—Mr. Taylor and Mr. Heisch. Monday, Wednesday, Friday, and Saturday, at 11. One session, £6 6s.

SUMMER SESSION.

Practical Chemistry.—Mr. Taylor and Mr. Heisch. Monday, Wednesday, and Friday, at 11. One session, £3 3s.

ST. THOMAS'S HOSPITAL.

WINTER SESSION.

Lecturer.—Dr. A. J. Bernays. Tuesday, Thursday, and Saturday, at 11. One course, £5 5s.

SUMMER SESSION.

Practical Chemistry.—Dr. A. J. Bernays. Tuesday and Thursday, 10 to 12; Friday, 11; Saturday, 10 to 1. One course, £3 3s.

WESTMINSTER HOSPITAL.

WINTER SESSION.

Lecturer.—Dr. A. Dupré, F.C.S. Tuesday and Thursday, at 3 p.m.; Friday, at 3.30 p.m. One course, £5.

SUMMER SESSION.

Practical Chemistry.—Dr. A. Dupré, F.C.S. Tuesday and Thursday, at 10 a.m. One course, £2.

PRIVATE TEACHERS OF CHEMISTRY IN LONDON.

Mr. J. C. Braithwaite, 54, Kentish Town Road, N.W.—Chemistry and Toxicology, Monday and Thursday; Latin, Tuesday and Friday; Botany and Materia Medica, Wednesday and Saturday. All the classes commence at 8 p.m. Laboratory open daily, except Saturdays.

Mr. Henry Matthews, F.C.S.—Laboratory, 60, Gower Street, Bedford Square. Instruction in all branches of Practical Chemistry, particularly in its application to Medicine, Agriculture, and Commerce. Laboratory open daily, except Saturday, from 10 to 5; on Saturday, from 10 to 1.

Mr. A. Vacher, 20, Great Marlborough Street, Regent Street.

Mr. John Newlands, F.C.S.—Laboratory, 13, Knowle Road, Brixton, S.W. Gives practical instruction in Analysis, and prepares gentlemen for various public examinations.

Dr. John Muter, M.A.—Laboratory, 289, Kennington Road. Instruction in Practical Chemistry and Pharmacy.

UNIVERSITY OF OXFORD.

Professor of Chemistry.—Sir B. C. Brodie, Bart., M.A., F.R.S.

Demonstrator.—E. Madan, M.A.

A commodious Laboratory is attached to the New Museum.

Scholarships of about the value of £75 are obtainable at Christ Church, Magdalen, and other Colleges, by competitive examination in Natural Science.

UNIVERSITY OF CAMBRIDGE.

Professor of Chemistry.—G. D. Liveing, M.A.

MICHAELMAS TERM.

Practical Chemistry, by the Professor, on Mondays, Wednesdays, and Fridays, at 1 p.m.

LENT TERM.

Chemistry, by the Professor, on Mondays, Wednesdays, and Fridays, at 12.

Practical Chemistry, on the same days, at 1 p.m.

EASTER TERM.

Chemistry, by the Professor, on Mondays, Wednesdays, and Fridays, at 12.

Practical Chemistry, on the same days, at 1 p.m.

The Chemical Laboratory of the University is open daily, from 10 a.m. till 6 p.m.; so that Students can work there at such times as may be convenient to them; and the Professor will attend to give instruction at the times above specified.

PROVINCIAL SCHOOLS.

BIRMINGHAM.—MIDLAND INSTITUTE.

Lecturer on Chemistry.—Mr. C. J. Woodward, B.Sc. Tuesday and Thursday, at 8 p.m.

Practical Chemistry.—Mr. C. J. Woodward, B.Sc. Saturday, 3 to 6, and 6.30 to 9.30 p.m.

BIRMINGHAM.—QUEEN'S COLLEGE.

WINTER SESSION.

Professor of Chemistry.—Alfred Hill, M.D., Borough Analyst. Tuesday, Thursday, and Friday, at 12.

SUMMER SESSION.

Practical Chemistry.—Professor A. Anderson. Thursday, at 1 p.m.; Friday, at 2 p.m.

BRISTOL.—BRISTOL MEDICAL SCHOOL.

WINTER SESSION.

Lecturer.—Mr. Thomas Coomber, F.C.S. Monday, Tuesday, Wednesday, and Thursday, at 8.15. One Course, £5 5s.

SUMMER SESSION.

Practical Chemistry.—Mr. T. Coomber, F.C.S. Daily, except Saturday, at 8 a.m. One Course, £3 3s.

ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

Professor of Chemistry.—A. H. Church, M.A., Oxon.

Assistant to Chemical Professor.—E. Kinch.

The Collegiate year is divided into Two Sessions. The Autumn Session commences August 9th, divides October 6th, and ends about December 16th. During each Session, the Lectures given and Practical Classes held in the Chemical department are as follows:—

1. *Inorganic Chemistry*—Thirty-six Illustrated Lectures; Ten Catechetical Lectures.
2. *Organic Chemistry.*—Thirty-six Lectures.
3. *Agricultural Chemistry.*—Twenty-eight Lectures.

1. *Chemical Manipulation.*—Twenty-eight Lessons.
2. *Qualitative Analysis.*—Thirty-six Lessons.
3. *Quantitative Analysis.*—A certain number of Lessons.

The Laboratory is also open several hours each day for advanced Students, who occupy themselves, under the direction of the Professor and his Assistant, with the Analysis of Soils, Manures, Feeding Stuffs, Waters, &c.

LIVERPOOL ROYAL INFIRMARY SCHOOL OF MEDICINE.

WINTER SESSION.

Chemical Lecturer.—Mr. J. C. Brown, B.Sc., F.C.S. Tuesday, Thursday, and Friday, at 10.15. One course, £5 5s.

SUMMER SESSION.

Practical Chemistry.—Mr. J. C. Brown, B.Sc., F.C.S. Monday, Tuesday, and Friday, at 10.15. One course, £3 3s.

The Laboratory is open daily, from 10 to 4.

SCHOOL OF TECHNICAL CHEMISTRY,

7, IRWELL CHAMBERS, OLD HALL STREET, LIVERPOOL.

Conducted by Mr. A. Norman Tate. Assistants—Mr. Walter Tate and Mr. Arnold Millson.

Pupils may attend at any time between the hours of 9.30 a.m. and 5 p.m. (Saturdays, 9.30 a.m. and 1 p.m.), and may work every day, or any number of days, or portion of a day in the week, and for any period most convenient to themselves.

A separate working bench is provided for each Student; and he will also be supplied with all the ordinary chemicals (with the exception of gold, silver, and platinum solutions, alcohol, ether, and similar costly reagents), books for

reference, gas, and fuel, and will be allowed the use of balances and weights, and the most substantial portions of laboratory apparatus; but he must provide himself with test tubes, beakers, and other glass vessels and apparatus of a fragile nature required in his researches.

The Course of Instruction, in addition to the ordinary chemical studies, comprises such other subjects as may be required in the prosecution of the particular branch or branches of Applied Chemistry in which the pupil is to engage; as, for example, in the case of a pupil intended for manufacturing pursuits, he would study architectural and mechanical drawing, so far as is required for the preparation of plans, &c., of chemical apparatus and manufactories, the nature and use of building materials, and the scientific principles and practical rules involved in building and constructive operations, and other scientific and practical information required in the arrangement, construction, and management of chemical manufactories, and the application of chemistry to industrial pursuits.

COLLEGE OF CHEMISTRY, LIVERPOOL.

Principal.—Dr. Sheridan Muspratt, F.R.S.E., M.R.I.A., F.C.S., &c.

Assistant.—Mr. Martin Murphy, F.C.S.

The Course of Instruction in this College is entirely devoted to Laboratory work. The term is three months, and dates from time of entrance. Fee for working six days per week, £12 12s; five days, £11 11s.; four days, £10 10s.; three days, £9 9s.; two days, £8 8s.; and one day per week, £6 6s. Hours of attendance, from 10 a.m. till 5 p.m. The students' laboratories close at 1 p.m. on Saturdays.

Medical students may enter for one hour per day per session. Fee, £3 3s.

Certificates of attendance recognised by the University and Apothecaries' Hall of London, and Apothecaries' Hall of Ireland.

LEEDS SCHOOL OF MEDICINE.

WINTER SESSION.

Lecturer.—Mr. J. Chapman Wilson, F.C.S.

Daily, except Saturday, at 11 a.m. One course, £4 4s.

SUMMER SESSION.

Practical Chemistry.—Mr. Wilson, F.C.S.

Tuesdays and Thursdays, 11 to 12.30. One course, £2 2s.

LEEDS MECHANICS' INSTITUTION AND LITERARY SOCIETY'S LABORATORY.

SESSION 1869-70.

Chemical Classes for Instruction in Elementary, Practical, and Analytical Chemistry.

Teacher.—Mr. George Ward, F.C.S.

The usual Sessional Course of Instruction in abstract and Applied Chemistry will commence on Thursday, September 23rd, at 8 p.m., on which evening the teacher of the classes will introduce the general subject in a Lecture explanatory of its principles, of the mode in which these should be studied, and also of the plan which he purposes to adopt in conducting the classes during the session.

Fees, payable in advance:—Elementary Chemistry, Thursday, per session, £1 15s.; or 5s. 6d. per month. The subscription includes a selection of apparatus and material specially adapted for the course of instruction. To pupils providing their own materials, £1 1s. per session. Organic Chemistry, Friday, per session, 10s. 6d. Practical Chemistry, Tuesday, per session, £1 1s.; or 3s. 6d. per month. including apparatus and material. The session extends over seven months, from October to April inclusive.

HIGH HARROGATE COLLEGE, YORKSHIRE.

Professor of Chemistry.—W. G. Mason, F.C.S., Certificated Science Teacher.

MANCHESTER GRAMMAR SCHOOL.

DEPARTMENT OF MATHEMATICS AND PHYSICAL SCIENCE.

Masters.—T. S. Aldis, M.A. (Cantab.), W. M. Watts, D.Sc. (Lond.); J. Angell Esq.

There is a large Chemical Laboratory attached to the School, and Chemistry and the various branches of Physics are regularly taught. Arrangements can be made for students to devote their whole time to Physical Science and Mathematics.

MANCHESTER ROYAL SCHOOL OF MEDICINE.

Lecturer on Chemistry.—Mr. Daniel Stone.

The usual course for the Medical Boards.

A Laboratory is connected with the school.

OWEN'S COLLEGE, MANCHESTER.

(IN CONNECTION WITH THE UNIVERSITY OF LONDON.)

Chemistry.—Professor H.E. Roscoe, B.A., Ph.D., F.R.S., F.C.S.,

Junior Class.—Wednesday and Saturday, from 9·15 to 10·15 a.m.

Subject: Inorganic Chemistry, comprising the laws of chemical combination, and a description of the properties and mode of preparation of the non-metallic elementary bodies and their most important compounds.

Senior Class.—Tuesday and Thursday, from 9.15 to 10.15 a.m.

Subjects: Inorganic and Organic Chemistry, including the properties of the metals and their compounds, and the composition and relations of the best defined groups of organic bodies, and the laws regulating their formation.

Students are expected to answer the written exercises and attend the *viva voce* examinations given in these classes.

Fee, for each class, £3 3s. For both classes, £5 5s.

A Recapitulatory Lecture, without additional Fee, will be given on Friday at 9.15 a.m., which members of both classes will be required to attend.

Extra Class.—Wednesday, from four to five p.m.

Subject: Technological Chemistry.

The Chemical Principles involved in the most important Chemical Manufactures will be chiefly considered in this course. The subject will be discussed as follows, and as far as time will permit.

1. Production of Heat—Heat of Combustion—Combustibles—Coal.
2. Production of Light—Coal Gas—Measurement of Illuminating Power of Coal Gas—Distillation of Coal.
3. Water and Air, as regards their Sanitary and Technological Relations.
4. Processes concerned in the manufacture and application of the Alkalies.
5. Dyeing and Calico Printing.
6. Manufacture of Acids.
7. Manufacture of Glass and Porcelain.

Students attending this class must be acquainted with the principles of Chemical Science. Fee, £2 2s.

Analytical and Practical Chemistry.

LABORATORY COURSE.

Professor.—Henry E. Roscoe B.A., Ph.D., F.R.S.

Senior Assistant.—Mr. C. Schorlemmer, F.C.S.

Junior Assistant.—Mr. T. E. Thorpe, Ph.D.

The aim of this course is to make the student practically acquainted with Chemical Science, to enable him to conduct analysis and original research, and to fit him for applying the science to the higher branches of Art, Manufactures, and Agriculture. To accomplish this, an attendance of not less than four days per week during three whole sessions is as a rule necessary. It is very advisable that each Laboratory Student should attend or should have attended the course of Lectures on Theoretical Chemistry.

The College Laboratory will be open for students daily from 10.30 a.m. until 5 p.m., except Saturdays, when it will be closed at 1.30. The Laboratory is closed from 1.15 until 2, for dinner.

The Laboratory is fitted with every convenience for the prosecution of practical chemistry, all branches of qualitative and quantitative analysis, and original research.

Each student is provided with a separate working table, set of tests, fuel, water, and gas, free of expense; but he is required to find his own apparatus, a few of the more expensive reagents, and the chemicals required for his experiments. Other apparatus or instruments of a more expensive description may be obtained on loan from the Laboratory Steward, subject to regulations to be prescribed by the Professor.

Fees for the Session.—Students working six days per week, £21; ditto, four days, £17 17s.; ditto, three days, £13 13s.; ditto, two days, £9 9s.; ditto, one day, £5 5s. Students entering the Laboratory Class at or after Christmas, for not less than two days per week, will be charged two-thirds of the fees for the whole session.

Special Fees for Shorter Periods.—For six months, six days per week, £17 17s.; five months, ditto, £15 15s.; four months, ditto, £13 13s.; three months, ditto, £10 10s.; two months, ditto, £7 7s.; one month, ditto, £4 4s.

Lectures on the methods of Qualitative and Quantitative Analysis, intended to supplement the instruction in Practical Chemistry, will be given by Mr. Schorlemmer, on Mondays, from 4 to 5 p.m.

First year's Laboratory Students are recommended to attend and answer the written exercises and the *viva voce* questions given in this class. Fee, £1 11s. 6d.

Chemical Calculations.—In this class, instruction and special practice is given, by Mr. Schorlemmer, on Wednesday, from 4 to 5 p.m., in the methods of Chemical Calculations, serving as supplementary to the Lecture and Laboratory Courses. Fee, £1 1s.

The Lectures on Chemistry in Owen's College are recognised by the University of London for its Medical Degrees, by the Royal College of Surgeons, and by the Apothecaries' Hall.

EVENING CLASSES.

Chemistry.

Professor H. E. Roscoe, B.A., Ph.D., F.R.S.

Lecture Class (First Course—The Non-Metallic Elements).—Monday, from 8.35 to 9.35 p.m.

Lecture Class (Second Course—The Metals).—Mr. T. E. Thorpe, Ph.D. Friday, from 8.35 to 9.35 p.m.

Lecture Class (Third Course—Organic Chemistry).—Mr. C. Schorlemmer, F.C.S. Friday, from 7.30 to 8.30 p.m.

Laboratory Courses of Practical Chemistry.

Professor Roscoe, F.R.S., and Mr. Schorlemmer, F.C.S.

Junior and Senior Divisions.—Monday, from 6 to 8.30 p.m.

Pharmaceutical Course.—Monday from 6 to 8.30 p.m.

COLLEGE OF MEDICINE, NEWCASTLE.

(IN CONNECTION WITH THE UNIVERSITY OF DURHAM).

Education in Pharmacy.—The Council of the College have added a Lectureship on Pharmacy to those at present existing. The proposed curriculum for Students in Pharmacy will consist of attendance on Lectures on Botany, Materia Medica, Chemistry, and Pharmacy. The Lectures on the two former of these subjects will be delivered in the summer, and those on the two latter in the winter session of study.

Lecturer on Chemistry.—Mr. A. Freire-Marreco.

Monday, Wednesday, Thursday, and Friday, at 4 p.m.

EVENING COURSES.

Chemical Physics.—Every Monday, at 7.30 p.m.

Inorganic Chemistry.—Every Wednesday, at 7.30 p.m.

Practical Pharmacy.—B. S. Proctor. Every Tuesday, at 7.30 p.m.

This course will include—General Processes and Physics applied to Pharmacy—Pharmacopœial Processes, and the most important recent improvements in Pharmaceutical preparations—Dispensing operations—Testing and the Test Solutions of the Pharmacopœia. The course will be illustrated, whenever practicable, with apparatus, experiments, and processes in operation.

Practice of Chemistry.—The Laboratories are open daily throughout the year from 10 to 5 o'clock. Non-Medical students can attend Laboratory practice and receive Instruction in Analysis.

Students attending the Laboratory practice and Lectures on Chemistry, who have passed the Durham Registration Examination, or any Examination in Arts recognised as its equivalent, will be registered on the books of the College as Matriculated Students in Chemistry.

Fees.—Perpetual ticket for Pharmacy Course, £6 6s (this applies only to Students at present engaged in Pharmacy, and who enter before October, 1871). Separate Courses of Lectures (each), £4 4s. Laboratory Practice, 6 days per week—Three months' ticket, £9 9s; six months' ticket, £16 16s.; twelve months' ticket, £31 10s. Special arrangements for shorter attendances. These fees admit to all the courses in Chemistry. For a certificate in Chemistry, 10s.

SHEFFIELD.

Mr. W. Baker, F.C.S. Laboratory for Theoretical and Practical Chemistry, 46, High Street, Sheffield.

SCHOOL OF CHEMISTRY,

1, SURREY STREET, SHEFFIELD.

Mr. A. H. Allen, F.C.S., delivers a Course of Thirty Lectures on Inorganic Chemistry, in connection with the Science and Art Department.

Day and Evening Classes for Analytical Chemistry.

SHEFFIELD SCHOOL OF MEDICINE.

During the Winter Session, Mr. A. H. Allen, F.C.S., will deliver a Course of Forty-five Lectures on Chemistry.

SCOTLAND.

UNIVERSITY OF EDINBURGH.

Professor of Chemistry.—Dr. A. Crum Brown, F.R.S.

ROYAL COLLEGE OF PHYSICIANS AND SURGEONS, EDINBURGH.

Lecturer on Chemistry.—Dr. Stevenson Macadam, F.R.S.E.

The Courses of instruction in Chemistry include its applications to Medicine, Agriculture, and the Industrial Arts; and they qualify for the University of Edinburgh, and other Universities; the Royal Colleges of Physicians and Surgeons, the Navy, Army, and Indian Medical Service, and the other Medical and Public Boards.

The Lectures on Chemistry commence on Wednesday, November 3rd, and continue to be delivered daily during the five months of the Winter Session. The Lectures form a complete Course; the New Nomenclature and Notation are employed throughout, and special Lectures in Technological Chemistry are given. Tutorial Class Examinations are held during the Session, and Excursions are arranged for visiting the principal Chemical Manufactories.

The Instructions in Analytical Chemistry are conducted in the Laboratories at Surgeons' Hall, which are now open daily, under the personal superintendence of Dr. Macadam, for the instruction of gentlemen in Chemical Analysis, and the prosecution of researches in Manipulative Chemistry.

The Prelections in Practical Chemistry are also conducted in the Laboratories at Surgeons' Hall. The objects

selected for Examination are those with which Medical Students are specially called upon to exhibit a practical acquaintance.

Fees.—Lecture, £3 5s. (University Graduation, £4 4s.); Practical Chemistry (University, &c.), £3 3s.; Analytical Chemistry, £2 per month, £5 for three months, or £10 for six months.

ANDERSONIAN UNIVERSITY, GLASGOW.

Professor of Chemistry.—Dr. Penny, F.R.S.E., F.C.S., &c.

1. Systematic Course of Lectures and Demonstrations on Chemistry, for Medical Students, Manufacturers, Civil Engineers, Agriculturists, &c. Daily, except Saturday, from 12 to 1, commencing 27th of October and terminating in April, £2 2s.

The object of this Course, which comprises upwards of 100 Lectures, is to convey to the student a thorough knowledge of the principles of Chemistry, and the applications of the science to Medicine, Manufactures, Agriculture, &c.

Certificates of attendance on these Lectures are received by the Royal College of Physicians of London and Edinburgh; by the Royal Colleges of Surgeons of England, Ireland, and Edinburgh; by the Faculty of Physicians and Surgeons of Glasgow; by the Army, Navy, and East India Boards; and by the Apothecaries' Halls. They also qualify for Graduation in the University of London, &c.

2. Instruction in the various branches of Practical Chemistry, and Analysis in the Laboratory. Daily, from 10 to 4.

After the usual preparatory training, the attention of the Student is specially directed to the examination and analysis of Minerals, Products of Commerce and Manufacture, Manures, &c., and, when desired, to Original Research.

3. The Private Laboratory for Commercial and Mineral analyses and assays, and for consultations and special investigations. Open daily, from 10 to 5, throughout the year.

4. Evening Course of Popular Lectures on the General Principles of Chemistry, and its application to the various branches of the Useful Arts. On Fridays, at 8.30.

Students attending this Course have the privilege of competing for the Prizes and Certificates offered by the Society of Arts, and the Government Department of Science and Art.

5. Evening Course of Instruction in Practical Chemistry and Analysis. On Thursday, from 7 to 9.

6. Summer Course of Practical Chemistry for Medical Students. Three months, commencing in May, £2 2s.

Young's Chair of Technical Chemistry.—This new Chair, which has been founded by Mr. James Young in connection with the Andersonian University, has been accepted by Mr. W. H. Perkin, F.R.S. We hear that the Laboratory will be opened in January next, and will accommodate about forty students.

UNIVERSITY OF GLASGOW.

Professor of Chemistry and Practical Chemistry.—Dr. Thomas Anderson, F.R.S.E.

GLASGOW MECHANICS' INSTITUTION.

Lecturer on Chemistry.—Dr. R. Carter Moffat.

1. Course of six months morning Lectures, qualifying for the various Medical Examinations, and also suited to the requirements of Manufacturers, Civil Engineers, &c. Daily, at 10. Begin 25th October.

2. Day and Evening Experimental Classes are held in the Laboratory, by Dr. R. Carter Moffat. Hours, from 10 till 4, and 7 till 9.

In these Classes, Students are instructed individually, and not as members of a class, so that every facility is given for the thorough attainment of the various principles and methods in Analysis, &c. Students may enter at any time; and the Classes are suitable for beginners as well as for advanced pupils. All are supplied with Apparatus, &c., and they personally perform their own Experiments. Those desiring it may take up, on entering, any department they choose—as, for example, the Analysis of Substances for Trade purposes, or investigations relative to the Improvement of certain Manufacturing Processes, and the Discovery of New Materials useful in the Arts, &c.

3. Popular Evening Lectures, every Monday, at 8.30, for six months.

4. Medical Students' Practical Class in Summer, commencing May 3rd. £2 2s.

GLASGOW VETERINARY COLLEGE.

Professor of Chemistry and Materia Medica.—Dr. R. Carter Moffat.

The Session will commence on Monday, October 25th, 1869.

IRELAND.

DUBLIN.—TRINITY COLLEGE.

Professor of Chemistry.—Dr. Apjohn, F.C.S.

The Lectures will commence on Wednesday, November 2nd, at 2 o'clock, and be continued each Tuesday, Thursday, and Saturday.

ROYAL COLLEGE OF SURGEONS, DUBLIN.

Professor of Chemistry.—Dr. Barker.

The Professor receives operating pupils into the Chemical Laboratory.

QUEEN'S COLLEGE, BELFAST.

Professor of Chemistry.—Dr. Andrews.

QUEEN'S COLLEGE, CORK.

Professor of Chemistry.—Dr. Blyth.

QUEEN'S COLLEGE, GALWAY.

Professor of Chemistry.—Dr. T. H. Rowney.

A Laboratory for Practical Instruction is attached to all the Queen's Colleges. The usual Practical Course for the Medical Boards is given in the summer.

ROYAL COLLEGE OF SCIENCE FOR IRELAND, STEPHEN'S GREEN, DUBLIN.

This College supplies, as far as practicable, a complete course of Instruction in Science, applicable to the Industrial Arts. The Subjects of Instruction are:—Pure and Applied Mathematics, Descriptive Geometry and Mechanical Drawing, Mechanism, Theoretical and Applied Chemistry, Chemical Analysis, Physics, Botany, Zoology, Geology and Paleontology, Mineralogy, Mining, Machinery, Surveying, and Agriculture.

Professor of Theoretical Chemistry.—W. K. Sullivan, Ph.D., V.P.R.I.

Professor of Analytical and Applied Chemistry.—R. Galloway, F.C.S.

Assistant Chemist.—Wm. Plunkett, F.C.S.

A Course of Lectures on Inorganic and Organic Chemistry is delivered by Dr. Sullivan three times a week during the session. Fee for the entire course, £2.

A Course of Lectures on Technological Chemistry is delivered by Mr. Galloway twice a week during the session. Fee for the course, £2.

The Chemical and Metallurgical Laboratories, under the Direction of Mr. Galloway, are open every week day during the session, except Saturday. Instruction is given in the different branches of Analytical Chemistry, including Assaying, and in the methods for performing Chemical research. Each student is taught, not in class, but separately and independently; and he is supplied with a separate working table, with reagents, fuel, water,

gas, and the larger and more expensive apparatus. Fee, for the session of nine months, £12; or for three months, £5; or for one month, £2.

Students have access to the extensive Library of scientific books in the College, and have the privilege of borrowing the books.

There are four Royal Scholarships, of the value of £50 each, yearly, with free Education, including Laboratory Instruction, tenable for two years; two become vacant each year; they are given to students who have been a year in the College. There are also nine Exhibitions attached to the College, of the yearly value of £50 each, with free Education, including Laboratory Instruction, tenable for three years; three become vacant each year. These are awarded at the annual May Examinations of the Science and Art Department.

A Diploma of Associate of the College is granted at the end of the three years' Course.

The Session commences on Monday, October 4th.

ON SPIRIT MADE FROM RICE.

By JAMES BELL, Esq.

THERE has always been a difficulty experienced in producing from rice a spirit free from a pungent odour. An impression prevailed that the pungency was due to the presence of some compound ether generated during the process of fermentation; but how or why it was produced in the fermentation of a saccharine extract prepared from rice, and not in that obtained in the ordinary way from other materials, was a problem which appeared difficult of solution.

In the course of manufacture of spirit from rice, sulphuric acid is the agent employed for converting the starch of the rice into glucose, and this process is conducted in a close wooden vessel under steam pressure at a temperature ranging from 216° to 230° Fahr. It has been observed that when the process of saccharisation was conducted at a temperature approaching 230°, the spirit obtained was more pungent than if the lower temperature had been observed. It has also been remarked that the pungency of the spirit was less in proportion as the rice was purified or freed from the husk.

Being desirous to investigate this subject, I undertook the examination of a sample of rice spirit which was placed at my disposal, and which had been made from rice that had been only partially freed from the husk, and though it appeared that the temperature during the process of saccharisation was maintained at about 216° Fahr., the spirit was very pungent.

The spirit was found, on the application of a slight heat, to freely reduce ammoniacal nitrate of silver, but without depositing the metal in a specular form; and a very small quantity sufficed to instantly decompose a solution of a permanganate.

When a portion of the spirit was treated in the cold with caustic potash and allowed to stand for a few hours, the pungency rapidly disappeared, and there was simultaneously produced a dark brown resinous substance soluble in alcohol and ether. The spirit recovered by distillation from the alcoholic alkaline solution was free from acrid odour, and gave the normal reaction with the mercury compounds for ethylic alcohol.

The addition of a very small quantity of the acid sulphite of sodium to the spirit, rapidly destroyed the pungent odour, and the alcohol obtained afterwards by distillation was unobjectionable in quality.

These reactions, it will be seen, pointed directly to the presence of an aldehyde, and in order to identify it, a portion of the spirit was introduced into a stoppered bottle, and treated in the cold with moist oxide of silver and left in contact therewith for several days. At the end of this time, there was a slight deposit of the metal on the glass, as well as other evidence that a quantity of the oxide had been reduced. To obtain the oxidised product, the excess of oxide of silver was removed by filtration and the silver salt in solution exactly decomposed with hydrochloric acid. The precipitate of chloride of silver was then filtered off, and the liberated acid neutralised with baryta and the spirit distilled. The distillate obtained was destitute of pungent odour, and the spirit was commercially pure.

The baryta salt which formed the residue in the retort was decomposed with sulphuric acid, and the liberated organic acid separated from the insoluble sulphate by distillation. The acid thus obtained proved to be acrylic, which had been produced from acrylic aldehyde by oxidation, and consequently, it was to the presence of this aldehyde that the pungent odour of the spirit was due.

There can hardly be a doubt that it is during the process of saccharisation that the fatty substances contained in the rice are decomposed; and that the acrolein is immediately thereupon produced by the action of the sulphuric acid upon the glycerine; and this view would seem to be borne out by the fact stated above, that a variation in the steam pressure in conducting the process of saccharisation affected the quantity of the acrolein produced.

It is well known that fats in a state of emulsion are in a condition to be readily acted upon by chemical reagents and to be decomposed, and it is not improbable that the conditions in this case are favourable to the action of the sulphuric acid upon the fatty substances in the rice, and in effecting their decomposition.

A sample of the rice from which the spirit was prepared was found to contain 0·62 per cent of fats, and assuming that the whole of the glycerine contained therein was converted into acrylic aldehyde, and that 65 per cent of starch was actually utilised in the production of ethylic alcohol, every thousand grains of the latter would contain one grain and a-half of the aldehyde.

The fact has long been known that rice spirit contained some compound which possessed the property, like acetone, of dissolving and keeping in solution certain compounds of mercury which are insoluble in pure alcohol and in water; and that before the absence of wood naphtha in rice spirit could be established by the ordinary chemical tests, it was necessary to distil the spirit once or twice from caustic potash.

The sample of rice spirit in question possessed the property of preventing the precipitation of the mercury compounds in an eminent degree, but the spirit after the complete separation of the acrylic aldehyde gave the normal reaction for pure alcohol.

To test the solvent power of acrolein for the mercury compounds, a small quantity of the aldehyde was prepared, and it was found to possess the property of preventing the precipitation of the ammonium compound of iodide of mercury in an alkaline solution, to nearly the same extent as acetone; and a very minute quantity of it was sufficient to impart a pungent odour to pure alcohol, similar to that possessed by the rice spirit.

MISCELLANEOUS.

Artificial Light.—The German chemist Landsberg says that artificial light contains 90 per cent of calorific rays, while sunlight contains only 50. To the number of these rays he attributes the disagreeable sensation produced upon the eyes by artificial light. By passing it through alum or mica, the calorific rays are interrupted, and the light rendered more agreeable and less injurious.

The Humboldt Centenary.—On the 14th of September, 1769, was born Alexander von Humboldt. According to the *Moniteur Belge* of this date, 1869, there is a plan on foot at Berlin to found and establish a Humboldt Palace, wherein would be united together the libraries of all the literary and scientific societies existing at Berlin, all of which would have th[illegible] meeting rooms in that palace also.

St. Bartholomew's Hospital and College.—The Winter Session will commence on Friday, October 1.

Students can reside within the Hospital walls, subject to the College Regulations.

For all particulars, concerning either the Hospital or College, application may be made, personally or by letter, to Mr. Morrant Baker, the Resident Warden; or at the Museum or Library.

St. Bartholomew's Hospital and College.—CLASSES for the UNIVERSITY OF LONDON.

MATRICULATION EXAMINATION.

There will be Two Classes held at St. Bartholomew's Hospital in each year, for the convenience of gentlemen preparing for the Matriculation Examination at the London University—from October to January, and from March till June. Provision will be made for teaching all the subjects required, as follows:—

(1) Classics, French, English, Modern Geography, and English History—Malcolm Laing, M.A., Trinity College, Cambridge.
(2) Mathematics and Natural Philosophy—P. J. Hensley, M.D., Cantab., Fellow of Christ's College, Cambridge, Tutor to the Hospital.
(3) Chemistry—A. Matthiessen, F.R.S., Lecturer on Chemistry to the Hospital.

Fee for the Course of Three Months .. 10 guineas.
Fee for (1) or (2) .. .. 5 guineas.
Fee for (3) .. .. 2 guineas.

PRELIMINARY SCIENTIFIC EXAMINATION.

A Class in the subjects required for the preliminary Scientific Examination will be held from January to July, and will include all the subjects required, as follows:—

Chemistry—A. Matthiessen, F.R.S.
Botany—Rev. G. Henslow, M.A., Cantab., F.L.S., Lecturer on Botany to the Hospital.
Zoology and Comparative Anatomy—W. S. Church, M.D. Oxon., Lecturer on Comparative Anatomy to the Hospital; late Lee's Reader in Anatomy at Christchurch, Oxford.
Mechanical and Natural Philosophy—P. J. Hensley, M.D., Cantab.

Fee to Students of the Hospital .. .. 6 guineas.
Fee to others .. .. 10 guineas.
Fee for any single subject .. .. .. 3 guineas.

Further information may be obtained on application, personally or by letter, to the Resident Warden of the College, St. Bartholomew's Hospital.

University of Aberdeen.—Chancellor, His Grace the Duke of Richmond. *Vice-Chancellor and Principal*, the Very Rev. P. C. Campbell, D.D. *Lord Rector*, M. E. Grant Duff, M.A., M.P.

FACULTY OF MEDICINE—SESSION 1869-70.

WINTER SESSION, Commencing on Wednesday, October 27.

Anatomy—Professor Struthers, M.D. 11 a.m. £3 3s.
Practical Anatomy and Demonstrations—Professor Struthers and the Demonstrator. 9 to 4, and 2 p.m. £2 2s.
Chemistry—Professor Brazier. 3 p.m. £3 3s.
Institutes of Medicine—Professor Ogilvie, M.D. 4 p.m. £3 3s.
Surgery—Professor Pirrie, C.M., F.R.S.E. 10 a.m. £3 3s.
Practice of Medicine—Professor Macrobin, M.D. 3 p.m. £3 3s.
Midwifery and Diseases of Women and Children—Professor Inglis, M.D. £3 3s.
Zoology, with Comparative Anatomy—Professor Nicol, F.G.S. 2 p.m. £3 3s.
Medical Logic and Medical Jurisprudence—Professor Ogston, M.D. 9 a.m. £3 3s.

SUMMER SESSION, Commencing on the First Monday of May.

Botany—Professor Dickie, M.D. 9 a.m. £3 3s.
Materia Medica (100 Lectures)—Professor Harvey, M.D. 3 and 4 p.m. £3 3s.
Practical Anatomy and Demonstrations—Professor Struthers and the Demonstrator. 9 to 4, and 2 p.m. £2 2s.
Practical Chemistry—Professor Brazier. 10 a.m. £3 3s.
Zoology, with Comparative Anatomy—Professor Nicol. 11 a.m. £3 3s.

Matriculation Fee (including all dues) for the Winter and Summer Sessions, £1. For the Summer Session alone, 10s.

Royal Infirmary—Daily, at Noon. Perpetual Fee to Hospital Practice, £6; or, first year, £3 10s., second year, £3.

Clinical Medicine—Drs. Harvey and Smith. £3 3s.
Clinical Surgery—Drs. Keith and Pirrie. £3 3s.

General Dispensary, and Lying-in and Vaccine Institution—Daily. Eye Institution—Daily. Royal Lunatic Asylum—Clinical Instruction is given for Three Months in the year.

The Regulations relative to the Registration of Students of Medicine, and the Granting of Degrees in Medicine and Surgery, may be had of Dr. Macrobin, Dean of the Faculty of Medicine.

Full information regarding the Classes and Degrees in the Faculties of Arts, Law, and Divinity, and in regard to Bursaries and Scholarships, will be found in the University Calendar, published by Messrs. Wyllie and Son, Union Street Aberdeen, by post, 1s. 8d.

Medical Education.—St. Mary's Hospital MEDICAL SCHOOL, Paddington, will open on October 1st, 1869. In addition to the usual courses, special instruction is provided in Operative Minor Surgery and Bandaging, Ophthalmic, Aural, and Dental Surgery, Comparative Anatomy, Histology, and Pathology; all of which are taught practically by demonstration as well as lecture. For prospectus, apply to

W. B. CHEADLE, M.D., Dean of the School.

St. George's Hospital Medical School.—The WINTER SESSION will commence on Friday, 1st October, with an Introductory Address by Dr. WADHAM, at 2 p.m., in the Hospital.

Consulting Physicians—Dr. Wilson, Dr. Bence Jones, Dr. Pitman.
Physicians—Dr. Fuller, Dr. Barclay, Dr. John Ogle, Dr. Wadham.
Assistant-Physicians—Dr. Dickinson, Dr. William Ogle.
Physician-Accoucheur—Dr. John Clarke.
Consulting-Surgeons—Mr. Cæsar Hawkins, Mr. Cutler, Mr. Tatum.
Surgeons—Mr. Hewett, Mr. Pollock, Mr. Henry Lee, Mr. Holmes.
Assistant-Surgeons—Mr. Rouse, Mr. Pick.
Ophthalmic Surgeon—Mr. Henry Power.
Orthopædic Surgeon—Mr. Brodhurst.

A Maternity Department and Departments for Ophthalmic and Dental Surgery are arranged in connection with the Hospital School.

LECTURERS.

Descriptive and Surgical Anatomy—Mr. Rouse.
Physiology and General Anatomy—Dr. Wm. Ogle.
Chemistry—Dr. Noad, F.R.S.
Medicine—Dr. Barclay.
Psychological Medicine—Dr. Blandford.
Surgery—Mr. Holmes.
Ophthalmic Surgery—Mr. Power.
Orthopædic Surgery—Mr. Brodhurst.
Operative Surgery—Mr. Rouse.
Pathology and Morbid Anatomy—Dr. John Ogle.
Midwifery—Dr. John Clarke.
Materia Medica—Dr. Dickinson.
Forensic Medicine—Dr. Wadham.
Dental Surgery—Mr. Vasey.
Botany—Mr. Child, F.L.S.

Clinical Lectures by the Physicians and Surgeons every week.

A Medical Tutor is appointed to superintend the studies of the pupils, and hold periodical examinations.

On payment of one hundred guineas at entrance, a Pupil becomes perpetual to the Hospital Practice and all the Lectures.

Compounders pay forty guineas on admission, forty guineas for the second year, and ten guineas for each subsequent year, until their payments shall have reached one hundred and ten guineas, when they become perpetual pupils.

Gentlemen may enter separately to Medical or Surgical Practice, or to any single course of Lectures.

Dental pupils are admitted on payment of £45.

The Pupils attending the Practice of the Hospital will be divided into classes among the Physicians and Surgeons in rotation, and each of them will be required to act as Clinical Clerks and Dressers to the Medical Officer to whom they are attached.

Special Demonstrations of Skin Diseases and Lectures on Public Health will form part of the course of Lectures on the Practice of Medicine; and Students will be required also to attend the separate courses of Lectures on Pathology and on Psychological Medicine.

In connection with the Lectures on Surgery, Demonstrations will be given on the Use of the Laryngoscope. A separate course of Lectures on Diseases of the Eye, with Demonstrations of the Use of the Ophthalmoscope, will be given, as well as Lectures on Orthopædic Surgery, with Illustrations of Deformities and their Treatment. Attendance on each of these courses will be required of Surgical Pupils.

In the Maternity Department, special Clinical Instruction will be given on Diseases peculiar to Women, and Practical Instruction in Vaccination to those who require certificates of proficiency.

House-Physicians and House-Surgeons are selected from among the senior Students according to merit, without further payment beyond a small sum paid to the Hospital for board.

The offices of Obstetric Assistant, Curator of the Museum, Medical and Surgical Registrars, and Demonstrator of Anatomy, with salaries of from £50 to £100 attached to each, are held out for competition annually. The William Brown Exhibition of £40 per annum, tenable for three years, is bestowed after a competitive examination. Clinical Prizes are offered annually by Sir Benjamin Brodie and Dr. Acland. Sir Charles Clarke's "Good Conduct" Prize, the Thompson Medal, and the Johnson Memorial Prize, are also to be competed for each year. A general examination of all the Students is held at the end of the Summer Session, and Prizes and Certificates of General Proficiency are given to the most deserving.

Further information may be obtained from Dr. Barclay, the Treasurer, or Mr. Holmes, the Dean of the Medical School, and from any of the Lecturers and Medical Officers of the Hospital.

New Kennington Institute.—The Popular Evening Lectures and Practical Classes in CHEMISTRY will re-commence on the 1st of October, under the direction of Dr. MUTER.

Tickets to be had of W. BAXTER, Hon. Sec., 182, Lower Kennington Lane.

THE CHEMICAL NEWS.

Vol. XX. No. 513.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

The object of the present series of articles is to place my own practice before beginners in microscopical science, for although there are a vast number of existing works on the microscope, many of them are of a popular nature and addressed to those who seek in the microscope a means of recreation rather than of scientific research. My wish is to supply simple and practical directions to aid the student, giving very much in detail such processes as are but little mentioned in books, and which are more usually learned by seeing the instrument in the hands of an experienced person; but as this is an advantage not accessible to every one, it would seem that there is still a want, which it is my hope that this and succeeding papers will help to supply, and prepare the student to consult with profit more elaborate treatises.

I have thought proper, therefore, to devote this article to the consideration of the instrument we have to work with. No workman is any the worse for a knowledge of the contents of his tool-chest; in fact, he will be far better qualified for making use of the appliances he possesses by knowing their construction.

Microscopes vary much in their details of construction, each maker having an instrument for which he claims its own especial merit. For convenience sake, the general plan of structure may be described as consisting of a tube containing the optical portion, capable of a sufficient range of motion to and from a support for the object to be examined, known as the stage, beneath which is placed a mirror, provided with the necessary adjustments for reflecting light upwards through the aperture in the stage.

The plans employed for supporting the tube containing the lenses, or "body," are two in number; in one, that adopted by Messrs. Beck and a few other makers, the body is supported by the greater part of its length, and runs in groove of peculiar form, which effectually prevents the detrimental movement known as "twist." In the other mode, the one used by Messrs. Ross, Powell and Leland, and the majority of opticians, the body is attached to the extremity of the cross-arm, the rack work moving up and down in a tube attached to the trunnions which carry the instrument between the two uprights connected with its base. This last plan of construction involves the use of a greater weight of metal and a more careful disposition of it to secure stability than where the body is supported in the former manner, but when skilfully made there is no practical objection to its employment.

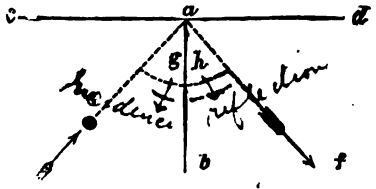
Dr. Carpenter speaks highly of the first mode, which is also approved of by Dr. Bowerbank: my experience is decidedly in its favour, my own instrument so constructed having been exposed to more than ten years' severe wear, and having had no substantial repairs during that period.

The part of the microscope I wish to direct attention to in the first instance, is the body and its contents. A combination of lenses called the object glass is screwed to the bottom of the tube, and another called the eye-piece, is placed at the top. For the sake of simplicity, the binocular arrangement will be for the present omitted, the instrument being supposed to have but a single body. In order that the use of the glasses contained in this tube may be understood, I must direct attention in the first place to some of the properties of light.

A *ray* of light, which is a very arbitrary term, may be considered, for the present purpose, as a small cylinder of light—a thing which has no real existence in nature, but will serve well for the purpose of demonstration. It is very much what the line is in mathematics.

Should this ray of light fall upon a polished surface which is not capable of allowing it to go through, or, in other words, an opaque polished surface like a bright plate of metal, *c*, *d* (Fig. 1), if the ray of light, *b*, *a*, falls upon that surface perpendicularly, it will be sent back by the same course through which it came down. On the contrary, should the ray of light *c*, *a*, fall obliquely, it will

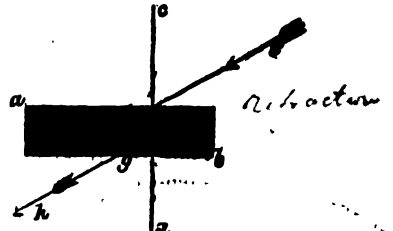
Fig. 1.



be reflected at an angle, *b*, *a*, *f*, equal to that *e*, *a*, *b*, at which it fell upon the reflecting medium. This angle of incidence, *e*, *a*, *b*, will be equal to the angle of reflection, *b*, *a*, *f*. Now this principle is made use of in our commonest means of illumination,—the mirror under the stage by which the light from a lamp or other source of light at one side or in front of the microscope, or in any other convenient place, is directed through the axis of the instrument. In the subsequent papers I shall say more about the application of the reflective principle. This is the only instance to be noticed at present.

Now, supposing that the ray of light falls upon a transparent material (a plate of glass, for example, a substance more dense than air), should the ray, *c*, *d*, fall upon this plate of glass, *a*, *b* (Fig. 2), perpendicularly,

Fig. 2.



it passes it straight through without any alteration taking place; but should the ray of light, *c*, *f*, fall obliquely, it will no longer pass through in the same direction, but will be bent towards the perpendicular.

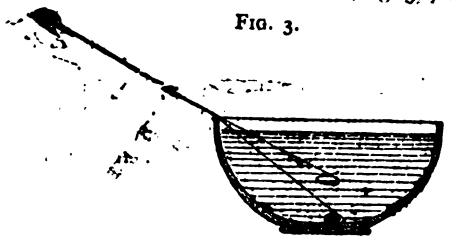
* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

c, *d*, in a greater or less degree according to the density of the medium, as at *f*, *g*, and is bent again upon its emergence into the rarer medium at *g*, towards *h*.

The amount of "refraction," as this bending is called, would be much less with water than it would be with glass, and it would be greatest of all in the diamond, other substances refracting in intermediate degrees.

The effect of refraction is familiarly illustrated by the well-known phenomenon of objects immersed in water appearing to be nearer the surface than they really are, a pool appearing to be only three or four feet deep, when in reality it is nearer six or eight. This may be readily demonstrated by placing a stick or other object in a basin of water (Fig. 3); the stick

Fig. 3.



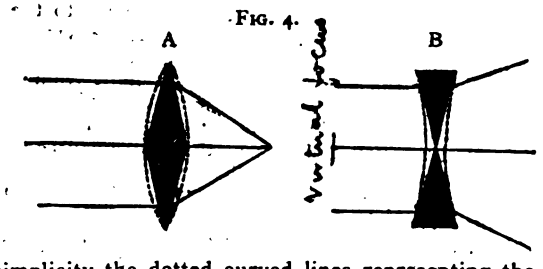
will appear bent where it enters the water; a coin or other object will appear to be at a much less depth than it actually is.

It is owing to refraction that we are able to make use of lenses, which give us the power of bending rays of light and turning them about in any way that may be required.

Lenses are circular pieces of glass or other transparent material capable of refracting light, and having curved surfaces, either convex or concave.

The action of a lens upon a ray of light will be best understood by reference to Fig 4. For the sake of

Fig. 4.



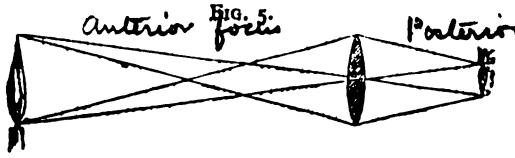
simplicity the dotted curved lines representing the section of the lenses may be considered as straight lines, as shown in the diagram.

It has been shown (Fig 2) that when a ray falls obliquely it is refracted, but that when it falls at right angles with the refracting medium it suffers no refraction. The central ray in both A and B passes straight through without refraction; in A the inclination of the surfaces is such that the rays passing above and below the centre line converge at a point called the focus. The lens, B, being thickest at the margin, the effect is just the reverse; the rays are dispersed, and do not come to a focus but diverge, as if they proceeded from a point on the opposite side of the lens, called the virtual focus. These concave lenses do not magnify, but are used in microscopes and other optical instruments, for purposes to be hereafter mentioned: the most familiar instances to be cited of their use are as the eye-glass of an opera-glass or Galilean telescope, and as spectacles for short-sighted persons.

Lenses may be made with one side worked to a plane surface and the other either convex or concave, such lenses are known as plano-convex and plano-concave lenses; their respective powers are about half those of lenses of similar and double curvatures. There are also lenses convex on one surface, and concave on the other; these are called meniscus lenses; the curves may be so proportioned that they have either the power of convex or concave lenses, according as they are thickest in the middle or at the edge; they have, moreover, some properties peculiar to themselves which are turned to good account by skilful opticians.

The formation of images is one of the most valuable properties of convex lenses, and one taken advantage of in the construction of optical instruments. If a convex lens is held at the distance of its focal length in front of a sheet of paper or other white surface, an inverted picture more or less distinct will be seen of objects that may be before it, such as a window or candle flame. This is illustrated by the diagram Fig. 5, representing a candle flame on the left hand, from the apex of which two rays diverge, the lower

Fig. 5.



one reaching the lower edge of the lens and the upper one its centre. Rays proceed from each point of the flame to every part of the surface of the lens, but, for the sake of clearness, only two are here represented. After passing through the lens they converge; the same takes place with the rays proceeding from the lower part of the flame, which also pass through the lens. The result is the formation of an inverted image, the size of which and its distance from the lens are dependent upon the distance of the object and the focal length of the lens.

The greater the distance of the object, or "anterior focus," the shorter will be the distance of the image, or "posterior focus." The commonest example may be taken from the operations of the photographer, who, if he wants to take a small portrait, will place the sitter at a great distance from the camera, if, on the contrary, he desires a large figure, he will bring his model nearer; in the former case the posterior focus of the camera will be shorter than in the latter, which is shown by the camera requiring to be lengthened when the model is brought near to it.

Besides the use of lenses to form images, they are also employed as magnifiers, and constitute the simplest form of microscope. Most naturalists and microscopists are provided with some little contrivance of this kind either attached to the watch chain or carried in the pocket,—either one or more lenses suitably mounted, or the Stanhope lens. In all these simple microscopes no image is formed, so that the principle upon which a magnified view is obtained is different. The idea of the magnitude of an object is formed entirely by the space which it occupies upon the retina of the eye. It is quite irrespective of its actual size; or, to express it in mathematical language, an object is large or small in proportion as it subtends a great or small angle with respect to the eye.

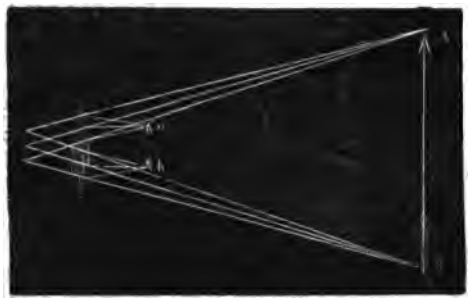
The eye has a certain power of adjusting itself to

view objects at different distances, but there is a limit to the distance of distinct vision. It varies from five to ten inches in different persons. An object cannot be distinctly seen nearer than either one or other of these distances, or some intermediate point. Now optical science supplies a means of overcoming this difficulty. An object apparently enlarged by being brought nearer to the eye, becomes indistinct, because the pencils of rays proceeding from it diverge too much to be brought to a focus on the retina by the lens of the eye.

The optical instrument most closely resembling the eye is the camera obscura. When the rack is run out to its full extent and the body is drawn out as far as it will go, and the object is still too near to be focussed distinctly, the position is precisely that of the eye with an object too close to it for distinct vision.

The remedy with the camera, supposing that no more focussing space could be obtained, would be to shorten the focus of the lens; that is, use one of greater refractive power. The same thing must be done in the case of indistinct vision, by interposing a convex lens and so increasing the convergent power of the lens of the eye; the object, hitherto too near the eye, *a*, *b*, is thus rendered visible and clearly defined, but with this remarkable difference, that it appears not to be the image of the object placed near the eye, but of a larger object, A, B, at the distance of distinct vision. No crossing of the rays takes place, and consequently the image is not inverted.

FIG. 6.*



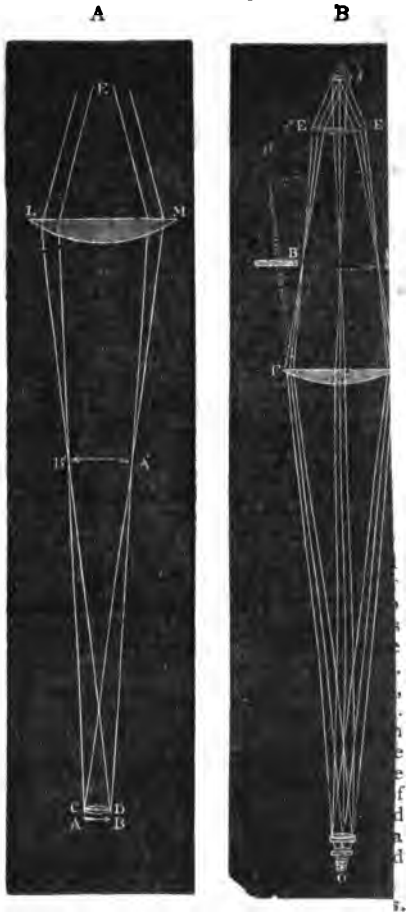
The hand magnifier is an extremely useful instrument, but many persons find great trouble in using it to advantage, especially when it is of short focus and high power. A trifling hint about its use may be of value.

Hold the object in the left hand, either in the fingers or with forceps, and, placing the left hand against the right which is holding the lens, look through the magnifier and adjust the focus. The view is usually most distinct when the eye is in one focus of the lens and the object in the other; the two hands being held in contact move together and prevent that tremor which would be apparent, especially with high powers, if the hands were kept apart, and which unsteadiness prevents any accurate view of the object being obtained. Single lenses, when their diameter exceeds that of the pupil, possess the property of bringing light to the eye and rendering the object clearer than it would be without such assistance. This may be proved by looking at print or other suitable object in a bad light and noticing how much the magnifier aids by its light-collecting power.

Single lenses are mounted on stands of various kinds, and then they become what are called single or simple microscopes. The older obser other instruments. These may consi lenses, while the compound microscope m with as few as two; but then they a principle that no image is formed, but t rendered visible at a shorter distance t be without optical aid. Single microsco in use for dissection and other purposes a low power is required. And various c have been adopted by which both eyes n and much fatigue saved in protracted op

The compound microscope differs from instrument just mentioned in an image b and again magnified by being viewed w lens or eye-piece (Fig. 7).

FIG. 7.



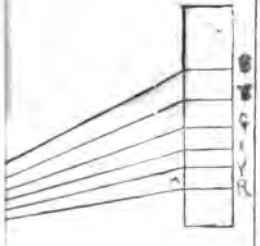
From what has been said before resp formation of images, it is evident if a le focus is used and an object placed before it will be formed at a great distance behi much enlarged; if instead of viewing directly, as in the camera obscura, it is v a suitable lens, another enlargement t Such an instrument might be construct two lenses, as in the diagram Fig. 7, A, but a so made would of course be a very imper ment; indeed it would in almost every inferior in its performance to that of a s principally because the eye lens magnifi

* Figs. 6, 7, 8, and 10 are taken from "The Microscope and its Revelations," by W. B. Carpenter, M.D. (Churchill).

rmed by the small lens perfections are chiefly hromatic aberrations of some degree by those of

s bring parallel rays to a distance from the lens of their curved sides; case; the rays passing n of the lens come to a om it than those which entre (Fig. 8). Those

e portions converge to vo points; the result is ormed at various points ell-defined figure being ses be made having an the spherical aberration e difficulties of making reat as to be considered rical aberration may be perture of the lens, by ion by means of stops or ise of this means causes tal to the performance ge may also be taken of ns is placed and also of rration of some lenses, niscus, is much affected being much greater in Much may be done by ost favourable position a striking example, take and observe the curious uction. The details of matter for the practical r an elementary treatise

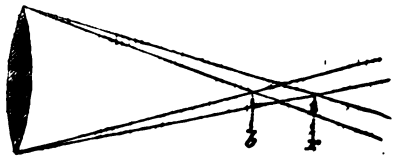


used by the unequal re- of a ray of light. If a h a glass prism, instead ther side as white light the unequal capability sess; the red ray is bent

istry," p. 173 (Churchill).

least, the yellow more, and the blue and violet most of all (Fig 9). This also takes place when light is caused to pass through a lens (Fig. 10). The blue ray

FIG. 10.



being the most refrangible comes to a focus nearest to the lens at *b*; the red ray being the least refrangible will not converge until it reaches *r*; the yellow, green, &c., rays come to a focus at intermediate points, so that a series of images surrounded by fringes of their respective colours would be formed at various points between *b* and *r*, such coloured margins rendering the definition extremely defective. Chromatic aberration may be lessened by the use of stops, cutting off the marginal portion of the lens, but at the sacrifice of a great quantity of light and the impairing of some of the most valuable qualities of the glass for microscopic purposes. Fortunately, a means has been found of almost entirely correcting chromatic aberration. Different kinds of glass vary not only in their refractive power but also in the degree in which they disperse the coloured rays, and, by combining lenses of suitable forms and materials, the error of one lens is so neutralised by the opposite error of the other that the combination as a whole is nearly free from the production of colour, or becomes, as it is termed, achromatic. For the practical application of this valuable fact, we are indebted to the elder Dollond, who constructed telescopes on this principle towards the end of the last century. The object glass of the microscope was not improved until many years afterwards.

Dollond first made achromatic

Owing to the very divergent condition of the rays proceeding from a minute object placed near the lens of a microscope, the construction of an achromatic object-glass is much more complex than the combination employed in other optical instruments. High powers contain as many as three combinations of compound lenses placed behind each other, the careful adaptation of which requires the greatest skill on the part of the optician, and necessarily causes objectives of large aperture and great perfection to be very costly. A valuable series of papers by Mr. F. H. Wenham on the construction of object-glasses for microscopes will be found in the *Monthly Microscopical Journal*, vol. I., pp. 111, &c.

So perfectly was the correction of the chromatic and spherical aberrations effected, that it was found that even the covering of the object to be viewed with a thin plate of glass or mica rendered the image sensibly indistinct: fortunately the defect was no sooner discovered than the late Andrew Ross applied a simple remedy; some alteration was made in the disposition of the correcting media, and the front combination allowed a small range of motion backwards and forwards, which is usually regulated by a graduated collar, the use of which it will be well to explain, as, although it is to be found in most works on the microscope, it seems to be generally overlooked. Makers differ a little in the details of their arrangement for this correction, but there will always be found some mark indicating when the object-glass is corrected, for viewing an uncovered object. Focus

carefully for distinct vision, with the glass so arranged, and then, taking hold of the collar, turn it round until a view is obtained of dust that may be resting on the upper surface of the cover of the slide; if the object is now focussed by the use of the fine adjustment, the correction for the thickness of the cover glass will be found to be very perfectly made, and as the collar is usually graduated, the number may be noted on the slide for future use, as it is constant with the same object and eye-piece, and also for the same thickness of cover-glass.

The eye-piece usually employed in the microscope in combination with achromatic object-glasses is that invented by Huyghens, a Dutch astronomer (Fig. 7, B), and consists of two plano-convex lenses (E E and F F), with their plane sides towards the eye; this eye-piece, although not achromatic, when used with object-glasses slightly "over-corrected," renders the instrument achromatic as a whole. The optical principles involved are far too complicated to find a place in the present paper.

The power of the instrument may be greatly varied by using a series of eye-pieces of different power, and if the corrections of the object-glass are perfect, and its angular aperture sufficient to admit a large amount of light, great advantage may be derived from the use of a short or "deep" eye-piece; but as the magnifying power of the eye-piece exaggerates every defect of the image, it is only with good object-glasses that this means of increasing the power is available. A very deep eye-piece is of value in testing the quality of an objective, as it causes defects which may not be apparent with lower powers to become very marked.

The power of the instrument is greatly influenced by the length of the tube or body, and were it not for the inconvenience of excessive length, this would probably be the least objectionable way of increasing the magnifying power, but a very long tube renders manipulation difficult, on account of its removing the hands to an uncomfortable distance from the stage and illuminating apparatus. Most microscopes have a sliding tube in the body known as the draw-tube, by which the length can be increased to the extent of four or six inches at pleasure.

(To be continued.)

PRELIMINARY NOTE ON A NEW CORNISH MINERAL.

By Professor CHURCH, M.A.

During a recent visit to Cornwall, I purchased from Mr. Talling, of Lostwithiel, some specimens of a dark brown, amorphous mineral which had been recently found by him. These prove to be an unrecognised silicate of iron. Here are, in brief, the characters of the new species:—

Hardness, 2·75; specific gravity, 1·74. Amorphous, reniform, fissured, dark brown. Streak, pale rust-brown. Fragile; fracture, irregular conchoidal. Blowpipe—in closed tube, much water, having slight permanent acid reaction; on charcoal, decrepitates, and becomes black; partially fuses in outer flame to a black bead, in inner to a red-brown. Boiled in acids, leaves a siliceous skeleton.

This mineral gives, on analysis, the following percentages:—

Water	10·51
Silica	36·39
Ferric oxide	52·94
	99·85

The mineral also contains 0·82 per cent of P_2O_5, and traces of magnesia. It loses 29 per cent. of water *in vacuo*, and only 0·54 per cent more at 100°. The analyses were made with the substance dried at 100° C.

The numbers above agree with the expression—

$$5Fe_2O_3,9SiO_2,8H_2O,$$

which demands 53·74 per cent Fe_2O_3, 36·58 per cent SiO_2, and 9·68 per cent H_2O; but many considerations point to the simpler formula, $Fe_2O_3,2SiO_2,2H_2O$, which demands—

	Theory.	Experiment.
$2H_2O$	11·39	10·51
$2SiO_2$	37·98	36·39
Fe_2O_3	50·63	52·94
	100·00	99·85

The chief discrepancy between theory and experiment concerns the iron, which is greater than it should be. This arises from three causes—(1) Traces of the iron exists as a ferrous salt in the mineral; (2) the percentage of Fe_2O_3 includes 0·82 per cent of P_2O_5; (3) is difficult to separate the haematitic matrix from every portion of the mineral taken for analysis. The causes which have raised the iron percentage have also been amongst those which have reduced the silica and water percentages below their theoretical amounts.

The new mineral, which I shall name on a future occasion, has been mistaken for beraunite: it accompanies pyrite, chalybite, quartz, black haematite, and cronstedtite.

Royal Agricultural College, Cirencester,
September 18th, 1869.

ON THE SUPPOSED ACTION OF LIGHT ON COMBUSTION.*

By CHARLES TOMLINSON, F.R.S., F.C.S.

The popular idea that "light puts out the fire," is so fixed, that probably no conclusions drawn from actual experiment are likely to disturb it, especially if they be adverse to the notion. It is a matter of daily experience, people say, that, if the fire is nearly out, and you put a screen before it, or draw down the blind, or close the window-shutters, it will immediately begin to revive. It is generally forgotten that a fire that looks dull, or "out," in a well lighted room, will appear to be in tolerable condition in the same room when darkened. It only requires to be "put together" to make it burn up, and it might have been done so just as well in the light.

Experiments on this subject are not easy to make, on account of the many disturbing causes. In an old volume of the "Annals of Philosophy," is an account of some experiments by Dr. M'Keever, who took two portions of green wax taper, each weighing 10 grains, and ignited both at the same moment. One piece was placed in a dark room, at 67° F.; the other was exposed to bright sunshine, at 78° F.

In five minutes { The taper in sunshine lost .. 8¼ grs.
" darkened room lost 9¼ "

The taper, divided into inches, was also burnt in the coloured portions of the solar spectrum, when it was found that the time required to burn two inches of taper varied as follows:—

	Mins.	Secs.
In the red ray it took	8	0
In the green	8	20
In the violet	8	39
In the verge of the violet ..	8	57

The conclusion is, that the solar rays, in proportion to their intensity, have the power of retarding, to a cer-

* Read before the British Association, Exeter Meeting, Section

siderable extent, the process of combustion; and it is supposed that the chemical rays act, in some way, on the portion of oxygen about to combine with the fuel, so as to delay, if not prevent, combination.

Supposing, in these experiments, the taper was so uniform, that one inch contained precisely the same quantity of matter as another inch, the time occupied in burning was too short to justify so important a conclusion as Dr. M'Keever arrived at, whether the results were taken by measure or by weight.

Everyone engaged in photometrical observations must be aware of the difficulty of getting rid of disturbing causes and perplexing results. In comparing candles of the same make, the light is affected, both in quantity and economy, by a number of small circumstances, such as the warmth of the room, the existence of slight currents of air, the extent to which the wick curls over in burning, and so on. In testing the quality of gas, the standard candle defined by Act of Parliament is a sperm candle of six to the pound, burning at the rate of 120 grains per hour. From such a standard, we get the terms "twelve candle gas," "fourteen candle gas," &c. Mr. Sugg, in his "Gas Manipulation," has pointed out some of the difficulties in obtaining a uniform standard candle. The wick does not always contain the same number of strands; they are not all twisted to the same degree of hardness; the so-called sperm may vary in composition—one candle containing a little more wax than another, or variable quantities of stearine or of paraffin; the candle may have been kept in store a long or a short time; the temperature of the store-room may have varied considerably, and the temperature of the room in which it was burnt may have been high or low. All these circumstances affect the rate of combustion, and the illuminating power of candles, irrespective of the action of light, if such action really exist.

I have lately had a good opportunity of testing this action at the works of Price's Patent Candle Company, at Battersea. Under the direction of Mr. Hatcher, the accomplished chemist of the Company, the greatest possible care is taken to ensure identity of composition and illuminating power in candles of the same name. There has lately been an extensive series of experiments on the photometrical value of sperm candles, during which, at my request, Mr. Hatcher was good enough to note the rate of combustion of such candles in a darkened room, and also in broad daylight, and even in sunshine.

In the first observation, three hard and three soft candles were burned, each for four hours, in a dark closet. A similar set of candles, taken from one and the same filling, were burned, during the same time, in open daylight, partly in sunlight. The average consumption per hour of each candle was as follows:—

Sperm, in the dark	.. .. ..	134 grs.
Ditto, in the light	.. .. ..	141 ,,
No. 2 composites	In the dark ..	133 grs.
	In the light ..	140 ,,

It must be noticed that the temperature in the light was 72°, and in the dark 71°; moreover, in the light there was a much greater motion of the air than in the dark closet. Both these circumstances would operate in producing a larger consumption of candle.

In a second trial with No. 2 composites, the results were:—

In the dark	..	140 grs. each candle.
In the light	..	134 ,, ,,

In a third trial, also with No. 2 composites, the results were:—

In the dark	.. ..	131 grs.
In the light	.. ..	129 ,,

In these two trials, the flames were protected, as far as possible, from currents of air; and, in a third trial, the temperature, both in the light and in the dark, was nearly equal.

The fourth trial was made on a bright, sunshiny day, with hard sperm candles, which are less affected by variations of temperature than the composites. The results were:—

In the dark (temperature, 81°), 544 grs., or 136 grs. per hour.

In the light (temperature, 84°), 567 grs., or 142 grs. per hour, nearly.

It is evident that, in this case, the increase of temperature caused by the bright sunshine led to an increased consumption of material.

It will be seen that, in the first and fourth trials, there is a greater consumption of material in the light than in the dark; and in the second and third trials, the consumption is greater in the dark than in the light; but, in any case, the difference is so small—amounting only to from 2 to 7 grains per hour—that it may fairly be referred to accidental circumstances, such as difference in temperature, in currents of air, and in the composition and make of the candles; the final conclusion to which I am led being that the direct light of the sun, or the diffused light of day, has no action on the rate of burning or in retarding the combustion of an ordinary candle.

SOME EXPERIMENTS WITH THE GREAT INDUCTION COIL AT THE ROYAL POLYTECHNIC.*

By JOHN HENRY PEPPER, F.C.S., Assoc. Inst. C.E.

The Large Induction Coil.

The length of the coil from end to end is 9 feet 10 inches, and the diameter 2 feet; the whole is cased in ebonite; it stands on two strong pillars covered with ebonite, the feet of the pillars being of a diameter of 22 inches. The ebonite tubes, &c. are the largest ever constructed by the Silver Town Works.

The total weight of the great coil is 15 cwts., that of the ebonite alone being 477 lbs.

The primary wire is made of copper of the highest conductivity, and weighs 145 lbs.; the diameter of this wire is 0·0925 of an inch, and the length 3770 yards. The number of revolutions of the primary wire round the core of soft iron is 6000, its arrangement being 3, 6, and 12 strands.

The total resistance of the primary is 2·201400 British Association units, and the resistances of the primary conductors are respectively—For three strands, 0·733800 B.A.U.; six, 0·366945 B.A.U.; twelve, 0·1834725 B.A.U.

The primary core consists of extremely soft straight iron wires 5 feet in length, and each wire is 0·0625 of an inch in diameter. The diameter of the combined wires is 4 inches, and the weight of the core is 123 lbs.

The secondary wire is 150 miles in length; it is covered with silk throughout, and the average diameter is 0·015 of an inch.

The total weight of this wire is 606 lbs., and the resistance 33,560 B.A. units. The length of the secondary coil is 50 inches, and the insulation throughout is calculated to be 95 per cent beyond that required. The secondary wire is insulated from the primary by means of an ebonite tube of ¼ an inch in thickness and 8 feet in length.

The length of the secondary coil is 54 inches, the diameter is 19 inches, and without the internal ebonite tube containing the primary wire and iron core it is a cylinder 19 inches in diameter and 6 inches thick.

The condenser, made in the usual manner with sheets of varnished paper and tinfoil, is arranged in six parts,

* Abstract of a paper communicated to the Royal Society, by J. P. Gassiot, F.R.S.

each containing 125 superficial feet, or 750 square feet of tinfoil in the whole.

A large and substantially made contact breaker, detached from the great coil and worked by an independent electromagnet, was constructed and worked very well with a comparatively moderate power of 10 or 20 large Bunsen's cells; when, however, the battery was increased to 30 or 40 cells, it became unmanageable.

A Foucault break, with the platinum amalgam and alcohol above it, was now tried, and answered very much better than the ordinary contact breaker; there was no longer any burning or destruction of the contact points, although the great power of the instrument appeared to cause continued decomposition in the water of the alcohol placed above the platinum amalgam; and every now and then the spirit was violently ejected, probably by explosion of the mixed gases taking place in the amalgam, in which they collected in bubbles; the alcohol took fire constantly, and had to be extinguished. A large and very strong glass vessel (in fact, an inverted glass cell belonging to a bichromate battery) was bored through, and the neck fitted into a cap with cement, a thick wire covered with platinum being inserted in the botton; the platinum amalgam was poured on this, and over it a pint or more of alcohol; the contact wire was also very thick and pointed with a thick stud of platinum, and, being attached to a spring, contact was easily made and broken. Explosions did not occur, flashes of light could be seen between the amalgam and the alcohol, and the height of the column of the latter prevented the forcible ejection of the spirit, which no longer took fire. The break was used for eight hours in a continuous series of experiments.

The Bunsen's battery used in the experiments was made with the largest porous cells that could be obtained, and each cell contained about one pint of nitric acid.

Some experiments were tried with the battery arranged for intensity, and used with the complete condenser of 750 square feet of tinfoil and 1500 square feet of paper. At first five cells were used, and these gave a spark 12 inches in length. The number of cells were gradually increased until 50 were in operation, when a spark from 28 to 29 inches in length was obtained.

In order to ascertain whether any variation in the size of the condenser would affect the length of the spark, a number of experiments were tried; and it was found that when half the condenser was used the spark increased in length up to twenty cells, but not after.

Experiments were now tried to ascertain whether any increase in the length of the spark could be obtained by arranging the battery and the primary coil for *quantity*, but no material advantage was obtained by this arrangement; even where three groups of cells were connected a decrease in the length of the spark is observed when compared with the 45 or 50 cells arranged for intensity, the difference being as 20 to 28.

The spark obtained from the large coil is thick and flame-like in its appearance, and therefore it will be alluded to as the "flaming spark."

When the discharging point and circular plate are brought within 6 or 7 inches of each other, the flaming nature of the spark becomes still more apparent.

Two light yellow flames curving upwards appear to connect the opposite poles. If a blast of air from powerful bellows is directed against a flaming spark, the flaming portion can be blown away and increased in area, and thin wiry sparks are now seen darting through it, sometimes in one continuous stream, at another time divided into three or more sparks, all following the direction in which the flame is blown.

The flaming spark is very hot, and if passed through asbestos (supported on an insulating pillar), quickly causes the latter to become red-hot.

When powdered charcoal is shaken from a pepper-box into the flaming spark in a vertical line and in considerable quantities, the greater part of the light is obscured, and the whole form of the flaming spark presents the appearance of a black cloud with a line of brightly ignited particles fringing the bottom parts. If the charcoal is dusted through in small quantities, each particle becomes ignited, like blowing charcoal into a hydrogen flame.

When the flaming spark is directed on to a glass plate upon which a little solution of lithium chloride is placed, the latter colours the flame upwards to the height of 3 or 4 in the most beautiful manner; and if the point of the discharge is tipped with paper, or sponge moistened with a little solution of sodium chloride, the two colours (the yellow from the salt, and the crimson from the lithium) meet each other, a neutral point being found about halfway, and thus illustrating apparently the dual character of electricity, and that + passes to − electrical, and *vice versâ*.

The flaming spark can be obtained in perfectly dry air.

Whilst passing through common air, if blown against a sheet of damp litmus-paper, the latter is rapidly changed red. In order to ascertain whether the acid product was nitric acid, the flaming spark (9 or 10 inches in length) was passed through a tube connected by a cork and bent tube with a bottle containing distilled water, from which another tube passed to the air-pump; on drawing the air slowly over the spark, and passing the former into the bottle, nitric acid was obtained in large quantities, so much so that it could be detected by the smell and taste as well as by the ordinary tests. The popular notion that nitric acid is always produced during a thunder-storm would therefore appear to be correct. To determine the effect of a cooling surface on the flaming spark, a hole 1½ inches in diameter was bored through a thick block of Wenham Lake ice, and the spark passed through the air in the tube of ice; no change took place, and the spark was still a flaming one.

When the spark was received on the ice, it lost its flaming character, and became thin and wiry, spreading out in all directions.

If the discharging wires were tipped with ice, the spark was always flaming when any thickness of air intervened between them. Even over the ice, if the spark passed a fraction of an inch above the surface, it was always a flaming one, but changed to the thin spark when the point of the discharging wire was thrust into the ice.

If one of the discharging wires of the great coil is brought to the centre of large swing looking-glass and the other wire connected with the amalgam at the back, the sparks are thin and wiry, arborescent, and very bright; the crackling noise of these discharges being quite different from that of the heavy thud or blow delivered by the flaming spark.

When the discharging wire is brought close to the flame of the looking-glass, or if a sufficient thickness of air intervenes, the spark again becomes flaming; or, as sometimes occurs, if the discharging wire is placed about 5 inches from the frame, the spark is partly flaming and partly wiry, *i. e.*, when it impinges on the glass.

The spectrum is a continuous one with the sodium-line.

When the blast of air is used, and the wiry sparks made apparent, then the nitrogen line appears.

The flaming spark has been ascribed by some experienced observers to the incandescence of the dust in the air, and especially sodium chloride.

To ascertain whether the "flaming spark" could be obtained with a small number of cells, the large Bunsen's battery was reduced to three cells, and it was found that no appreciable spark could be produced when the whole primary wire was used with less than five cells.

By reducing the length of the primary wire, and using the four divisions separately, with five cells the spark was wiry, and varied from 4½ inches to 6½ inches; with ten cells it was wiry, and varied from 8½ to 9½; in the latter the spark was slightly flaming. With fifteen cells the spark was slightly flaming, and varied from 10 inches to 11½ inches. With 20 cells a flaming spark varying from 11½ inches to 12½ inches was obtained.

When the two wires from the secondary coil are placed in water, no spark is perceptible, even when the wire was brought very close together, until they touch.

If the negative wire is passed through a cork, on which a glass tube (a lamp glass) is fixed containing a depth of 5 inches of water, and the positive wire is brought within half an inch of the surface of the water in the tube, it becomes red-hot, and if drawn further away from the surface the upper part of the tube is filled with a peculiar glow or light abounding in Stokes's rays.

The experiments with the vacuum tube, and especially Gassiot's cascade, are, as might be expected, very beautiful. When a coal-gas vacuum tube of considerable diameter, and conveying the full discharge from the secondary coil, is supported over a powerful electromagnet axially, the discharge is condensed and heat is produced.

If placed equatorially, the heat increases greatly, and when the discharge is condensed and impinges upon the sides of the glass tube, it becomes too hot to touch, and if the experiment was continued too long the tube would crack.

The enormous quantity of electricity of high tension which the coil evolves, when connected with a battery of forty cells, is shown by the rapidity with which it will charge a Leyden battery.

Under favourable circumstances, three contacts with the mercurial break will charge 40 square feet of glass.

On one occasion a series of twelve large Leyden jars arranged in cascade were discharged; the noise was great: and each time the spark (which was very condensed and brilliant) struck the metallic disk, the latter emitted a ringing sound, as if it had received a sharp blow from a small hammer.

The discharges were made from a point to a metallic disk; and when the former was positive the dense spark measured from 18¼ to 18¾ inches, and fell to 8¼ inches when the metallic plate was positive and the point negative.

Variations of the Leyden-jar experiments were tried by connecting the coil worked by a quantity battery of 25+25 cells with six Leyden jars arranged in cascade, and the spark obtained measured 8¼ inches.

The same six jars connected with the coil, when the fifty cells were arranged continuously for intensity, gave a spark of 12 inches of very great density and brilliancy.

NOTICES OF BOOKS.

Arithmetical Exercises for Chemical Students. By C. J. Woodward, B.Sc., Lecturer on Chemistry and Physics, Midland Institute, Birmingham. Birmingham: The Educational Trading Company (Limited). London: Simpkin, Marshall, and Co.

We have received, under the above title, a series of ten very neatly printed cards, enclosed in a case. Instead of "Exercises for Chemical Students," it would have been better to write Students of Chemistry.

The author very properly and truly states that, in almost all examination papers on the subject of chemistry, there are introduced questions involving considerable arithmetical calculation. Each card of this series contains all the data necessary for working the problems, and certain questions, which may be looked upon as *type* questions, are worked out in full. The subjects include—(1) the metric system of weights and measures; (2) conversion of thermometer scales—correction of gases for pressure and temperature; (3) specific gravity; (4) formula of a body being given, required either its percentage composition, or the quantity of any constituent a given weight of it will contain; (5) percentage composition of a compound being given, required its empirical formula; (6) quantity of material to yield, liberate, or produce a given weight of a substance; (7) required the bulk of a substance produced in certain decompositions, or, conversely, the volume of a substance necessary to effect certain decompositions; (8) combinations and decompositions of bodies in the gaseous form; (9) the crith and its uses; thermal units (by "crith" is understood the weight of 1 litre of hydrogen at 0° C., and 760 m.m. Barometer); (10) specific, atomic, and latent heat.

Very opportunely, these cards have been published at the moment that the courses of lectures are commenced at the various schools in the kingdom. A careful perusal justifies us, we think, in recommending these cards to all students of chemistry and physics; and a number of teachers will also find them a very useful addition to their library-table. As far as perusal goes, we have no fault to find with this work; and its very moderate price, especially considering the large amount of highly useful information contained in ten duodecimo cards, holds out a good inducement for students who really desire to obtain, within a very small compass, a permanently-useful pocket companion to purchase this work.

MISCELLANEOUS.

Death of the Master of the Mint.—With sincere regret, we learn that Professor Thomas Graham, F.R.S., Master of the Mint, died on Thursday night, the 16th inst., at his residence in Gordon Square. Mr. Graham succeeded Sir John Herschel at the Mint in April, 1855, and was, at the time of his decease, in his sixty-fourth year. He was born at Glasgow, on the 20th of December, 1805. He was the son of a Glasgow merchant, and was educated at the Grammar School and the University of that city, and afterwards spent some years in Edinburgh. He returned to Glasgow, where he distinguished himself as a practical chemist, and was elected Professor in the Andersonian Institution. In 1837, he was appointed Professor of Chemistry in University College, London, and, in 1855, he was appointed Master of the Mint. To the duties of this office he applied all his varied scientific knowledge, and, at the same time, devoted himself to original investigations in his favourite science. To him we are indebted for the discovery of the laws of the diffusion of gases, the diffusion of liquids, and the new method of separation known as dialysis. More recently, his analysis of an aërolite, which he found to be partly composed of hydrogen, afforded an interesting confirmation of the results obtained by spectrum analysis as to the constitution of heavenly bodies. His "Elements of Chemistry" is a standard work, and has had a large circulation both in England and Germany, the German translation being edited by Professor Otto, of Brunswick. In 1836, Mr. Graham became a Fellow of the Royal Society. In 1848, he was elected a Corresponding Member of the Academy of Sciences of the Institute of France; and, in 1855, the University of Oxford conferred upon him the honorary degree of D.C.L. The loss of the deceased *savant*, who was a bachelor, will be very seriously felt in the scientific world and also at the establishment of which he was the head, where he has rendered eminent service to the nation at large by the introduction of many great improvements.

The Whitworth Scholarships.—The following candidates have been reported to the Science and Art Department as entitled to the ten Whitworth scholarships of £100 a-year each:—William H. Greenwood, aged 23, engineer, student at the Mechanics' Institution, Manchester, 143 marks; Thomas A. Hearson, aged 23, engineer, student, Royal School of Naval Architecture, 137 marks; John Hopkinson, B.Sc., aged 19, student at Cambridge University, 134 marks; Thomas S. Elgood, aged 24, mechanical engineer, Leicester, and Owen's College, Manchester, 127 marks; George A. Greenhill,

aged 21, student at Christ's Hospital School and Cambridge University, 116 marks; John R. Brittle, aged 23, engineer, student at Sir Walter St. John's School, Battersea, 113 marks; Thomas W. Phillips, aged 23, student at British School, Millwall, and Royal College of Science, Dublin, 100 marks; Richard Sennett, aged 21, engineer, student at the Royal School of Naval Architecture, 98 marks; Robert B. Buckley, aged 21, engineer, student at Merchant Taylors' School, 97 marks; Charles E. Leeds, aged 23, B.A. (Oxon.), student at Oxford University, 96 marks.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, August 30, 1869.

This number contains the following original papers bearing upon, or more or less relating to, chemistry and allied sciences:—

Antidote of Nicotine.—M. Armand.—The author proposes that the deleterious effects of the use of tobacco should be counteracted, if not entirely annihilated, by moistening tobacco, while undergoing the various preparations and fermentations, previous to its delivery to the consumer, with a strong infusion, or other preparation, of watercresses, since the author has discovered that this vegetable contains principles which, without destroying the peculiar aroma of tobacco, destroy the deleterious effects of nicotine.

Action of Hydrate of Potassa upon the Sulphuretted Derivatives of the Carbides of Hydrogen.—M. Berthelot.—The author has studied the action of fusing caustic potassa upon the sulphuretted derivatives of some hydrocarbons which are not decomposed by water or alkalies at 100°. The soda-salt of hydrethylosulphuric acid, $C_4H_6S_2O_6$, is readily decomposed, and the result is the formation of pure ethylen and an alkaline sulphite—

$$C_4H_6NaS_2O_6 + KHO_2 = C_4H_4 + H_2O_3 + S_2KNaO_6.$$

Formenosulphate of soda, $C_2H_3NaS_2O_6$, should, by analogy, have yielded methylen, C_2H_2; but an excess of potassa decomposes the formenosulphate of soda, yielding hydrogen and carbonate and sulphite of alkalies—

$$C_2H_3NaS_2O_6 + 3KHO_2 = C_2K_2O_6 + S_2KNaO_6 + 3H.$$

With a relatively small quantity of potassa, a very volatile methylsulphide is formed, which, in many respects, is like methylic mercaptan. The author has extended his researches over a large number of equally complex compounds as those already alluded to; but, to be well understood, it would be required to quote a very large number of complicated formulæ; we therefore refrain from further abstraction of this paper.

Synthesis of Acetic Acid from Acetylen by a New Method.—M. Berthelot.—After referring to a now well-known method for the conversion of acetylen into acetic acid, devised by this author some time ago, the author now communicates another, and easier method—to wit, the heating of protochloride of acetylen, either with aqueous potassa solution up to 230°, or heating with an alcoholic solution of potassa up to 100°, for about ten hours. When the perchloride of acetylen is heated with an alcoholic solution of potassa up to 100°, glycolic acid is formed; and when the same perchloride is heated with aqueous potassa up to 230°, oxalic acid is formed.

September 6, 1869.

This number opens with a report on the practice of—

Heating Wines in order to Improve and make the same Keep Better.—M. Pasteur.—The contents of this paper are only interesting to wine growers. It appears, however, that the cautious heating of wine (on the large scale, and before it has reached maturity) not only improves its quality, but has the effect of making it keep better, and render fit for transport on long journeys, and by sea, such brands of French wines as are otherwise not suitable, on account of their rapid deterioration.

Detailed Account of the Spectrum of the Sun's Spots.—Rev. Father A. Secchi, S.J.—This indefatigable *savant* gives in this paper a very precise and fully detailed description of this difficult subject, which, however, since it is treated in a strictly astronomical style, we do not further allude to.

Nature of Aniline Green.—MM. A. W. Hofmann and Ch. Girard.—The authors treat, in this memoir, the following subjects:—*What is iodine green?* is a question first answered by stating that it is a secondary product, which is formed during the manufacture of the colouring matters generated by the methylation and ethylation of rosaniline, and known in commerce as Hofmann's violets. The preparation of iodine green (more correctly, green produced by iodine) is next treated at length; the preparation of this substance in crystallised state is then fully described. The composition of this green is—

$$C_{25}H_{32}N_2OI_2 = \left\{ \begin{matrix} H_{14} \\ C_{20}(CH_3)_2 \end{matrix} \right\} N_2 \left\{ \begin{matrix} CH_3I \\ CH_3I \end{matrix} \right\} H_2O.$$

This memoir is a very lengthy and exhaustive monograph on this subject not well suited for further condensation.

Thermochemical Researches on the Substances formed by Double Decomposition.—MM. Berthelot and Longuinine.—This memoir, divided into several chapters, is too much filled with a very large number of figures, without which this paper cannot be well understood, and, therefore, we regret that we can only here quote the title of a highly scientific memoir wherein the authors have laid down the results of a long series of carefully-made experiments.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 200, August, 1869.

Leaving the papers relating to mechanics, steam engineering, and watchmaking, met with in this number, we notice the conclusion of a very lengthy, yet very excellent, monograph on—

Truffles.—M. Chatin.—The chemical composition of these cryptogamic vegetables has been investigated at even so early a period of the infancy of chemical analysis as the year 1803, and at various epochs after that year, such investigations have been especially conducted in France. The latest researches on this subject have been recently made, and are quoted by the author, as well as the analysis made by M. Payen. From these we learn that the *Agaricus campestris*, the edible mushroom, contains, in 100 parts:—Water, 91·010; nitrogenous matter and traces of sulphur, 4·680; fatty matter, 0·396; cellulose, dextrin, sugar, and mannite, 3·456; saline matter, 0·458, among which there is a very large proportion of phosphoric acid. Genuine truffles contain 76·60 per cent of water and 23·40 per cent of solid matter, including 7·16 per cent of nitrogen; upon 100 parts, the ash of truffles contains 27·40 phosphoric acid, and 28·34 potassa; the quantity of phosphoric acid contained in the ash of truffles growing in the neighbourhood of Nérac amounts to 33·5 per cent. This paper contains valuable information on the cultivation of truffles, on the bibliography of this subject, and on the commercial importance of a vegetable which, at first sight, one would hardly credit to yield, to fifty departments of France, a sum of nearly 16,000,000 francs yearly. The author states that these vegetables are highly nutritious, and that, when taken at meals in lieu of butcher's meat, they are readily enough digested, provided they are properly cooked, for which purpose the author gives the necessary directions.

Estimation of the Quantity of Non-Saponified Fatty Matter contained in Soap.—Dr. Bolley.—Dry the soap at 100°, in order to eliminate, as much as possible, any water it contains. Treat the soap, after having been previously reduced to thin shavings, or powder, if possible, with rectified benzol, or petroleum naphtha. Boil the soap for several hours with this fluid placed in a retort, and take care to pour back into that vessel any of the hydrocarbon which distils over. Next filter the liquid, and evaporate on a water-bath. 11·3 grms. of Marseilles soap (this is made with inferior kinds of olive oil and soda) treated in this manner left a residue, on evaporation, weighing 0·145 grm., or 1·2 per cent; this quantity consisted of the non-saponified fatty matter, and a very small quantity of soap which had been dissolved. On igniting the residue just mentioned, it left 0·002 grm. of ash, equal to 0·13 per cent of the soap submitted to analysis.

Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, No. 6, 1869.

This number contains the following original papers relating to chemistry:—

Researches concerning the Isomerism of the Salicylic Series.—M. Henry.—The chief object of this lengthy memoir is the study of the action of pentabromide of phosphorus upon a number of salicylic compounds. Considering the existing analogy between pentachloride and pentabromide of phosphorus, the conclusion seemed justifiable that these two bodies would act in the same manner upon aldehyde and salicylic acid. The author's researches have proved that, instead of this supposition being correct, the pentabromide behaves as if it were free bromine, giving rise to the generation of bromated organic compounds only.

Researches concerning the Ethereal Derivatives of the Acids and Polyatomic Al[illegible] The author gives a review of his experiments [illegible] acetyl, obtained by the action of terchlori[illegible] glycollic acid. The author's aim was [illegible] to produce several diglycollic combi[illegible] esting for the glycid[illegible] however, been

Researches on the Derivatives of Phenyl-Acetic (α Toluic) Acid.—Dr. Radziszewski.—This memoir, like the two foregoing, of which the headings were mentioned, does not admit of suitable abstraction. This second portion of a monograph on this subject is divided into nine separate sections, and contains a complete and exhaustive review of a lengthy series of complex compounds derived from phenyl-acetic acid, $C_6H_5—CH_2—CO(OH)$.

The American Journal of Science and Arts, July, 1869.

This number contains the following original papers:—

Charles Grafton Page.—A biography of this deceased philosopher, who has been, for a series of years, one of the foremost scientific investigators of the Union.

Hortonolite, a New Member of the Chrysolite Group.—Messrs. Brush and Blake.—The mineral alluded to has a dark yellowish green colour on the fresh fracture, and a vitreous to resinous lustre; hardness, 6·5; sp. gr., 3·91. Before the blowpipe in the closed tube no change takes place; in the open tube, and on charcoal, the mineral becomes dull and magnetic, and fuses in the platinum forceps; with borax and salt of phosphorus it yields the reaction for iron and silicic acid, and with soda for manganese. The pulverised mineral forms, with hydrochloric acid, a gelatinous mass, and is almost completely decomposed. Average composition, in 100 parts:—Silica, 33·59; protoxide of iron, 44·37; protoxide of manganese, 4·35; magnesia, 16·68; lime, a trace; potash, 0·39; loss on ignition, 0·29. A spectroscopic examination of the concentrated chlorhydric solution showed sodium, potassium, and calcium lines only.

Effect of Atmospheric Air, when Mixed with Gas, in Reducing its Illuminating Power.—Messrs. B. Silliman and A. Wurtz.—The results arrived at by the authors may be summarised as follows:—For any quantity of air less than 5 per cent, mixed with gas, the loss in candle power due to the addition of each 1 per cent is a little over 6-10ths of a candle (0·611 exactly); above that quantity, the ratio of loss falls to half-candle power for each additional 1 per cent up to about 12 per cent of air; above which, up to 25 per cent, the loss in illuminating power is nearly 4-10ths of a candle for each 1 per cent of air added to the gas. With less than one-fourth of atmospheric air, not quite 15 per cent of the total illuminating power remains, and with between 30 and 40 per cent it totally disappears.

Formation of Sugar in the Liver.—Dr. Barker.—A physiologico-chemical essay.

Aurora at Toronto, Canada.—Mr. Kingston.

Qualitative Separation of Cobalt and Nickel.—Mr. F. W. Clarke.—As is well known, ferricyanide of potassium precipitates cobalt and nickel from their solutions. The cobalt precipitate is of a deep reddish brown colour, while the nickel compound is of a dirty yellowish brown. The nickel ferricyanide is readily soluble in ammonia and in solution of cyanide of potassium, while the corresponding cobalt compound is absolutely insoluble in either. It is a noteworthy fact that the previous presence of either ammonia or potassium-cyanide entirely prevents the precipitation of cobalt by the ferricyanide; the solution, when ammonia is present, merely assuming an intense blood-red colour. It is always best to employ ammonia to dissolve the nickel precipitate, since the presence of a cyanide renders the subsequent detection of that metal rather difficult. The author proceeds, as follows, in an analysis:—To the slightly acid solution containing the two metals, first an excess of chloride of ammonium is added; this causes the cobalt precipitate, which otherwise would run through the filter, to fall in a denser state, and also of much darker colour, often nearly black. The ferricyanide of potassium is then added, until the precipitation is complete, and afterwards strongly agitate with a considerable excess of ammonia. Upon filtering, all the cobalt remains upon the filter, being recognised by the characteristic colour of the precipitate, and the nickel is readily detected in the filtrate by means of ammonium-sulphide. This process is merely offered, the author states, as a convenient means of detecting cobalt and nickel in presence of each other in ordinary analyses.

Wollongongite, a remarkable Hydrocarbon found in the Wollongong District of the Illawarra Coal Field, N. S. Wales.—Mr. Silliman.—This remarkable substance occurs five miles inland, and forty miles south of Sydney, in cubical blocks, without lamination, extremely tough, and resounding like hard wood under the blows of the hammer. Hardness, 2·5; sp. gr., 1·04 to 1·49; lustre, resinous; colour, greenish black and brownish black; tasteless; insoluble in alcohol, ether, or benzol; slightly soluble in sulphide of carbon; heated in a test-tube, it does not melt, decrepitates and distils a copious flow of oil of a yellow colour and heavy odour, giving off much gas; it is readily kindled, in thin splints, by a match, burning with a brilliant flame and much smoke. Analysis in platinum crucible yields:—Volatile matter, 82·5 per cent; fixed carbon, 6·5 per cent; ash, 11·00 per cent.

Estimation of Carbonic Acid.—Mr. S. W. Johnson.—Since the woodcut added to this paper is absolutely required for it to be clearly understood, we do not abstract it here.

Journal für Gasbeleuchtung, July, 1869.

We notice from this number the following papers and communications of more general interest:—

Effect of Illuminating Gas upon Vegetation.—Dr. Poselger.—The author of this paper deserves the thanks of a great public for his energy in determining, by positive experiments, that the death of fine trees growing along the streets and promenades of many, especially continental, towns, is not due, as has been too often asserted, to the effects of leakage in gas mains. From the author's experiments, made with trees and shrubs, it is a settled point that no damage can accrue to the trees, nor their growth interfered with, by any quantity of gas which may escape in the soil and find its way to their roots. Moreover, the author points out that no care is taken at all with the trees, as regards keeping the soil covering the roots, so as to admit of air permeating freely; that too often that soil becomes as hard as rock; and that, in very many cases, the filthy habit of using trees, especially if so thick as to admit of a man hiding behind it, instead of urinals, contributes largely to the destruction of fine old trees. The leakage of gas, or the laying down of mains near the roots, has nothing to do with this destruction; other causes influence the decay of trees, but with these we do not further occupy ourselves.

Brief Abstracts from the Reports of the Meeting of German Gas Engineers and Gas-Works' Managers held at Coburg at the end of May.—*Analysis of Oberursteler Oxide of Iron.*—This material is applied for the purification of gas, and was found to consist principally of 36·5 per cent of a siliceous sand, 38 per cent of Fe_2O_3, and 11·7 per cent of Mn_2O_3. The material known as Mannheim oxide of iron contains 98 per cent of Fe_2O_3, and small quantities of lime and sand. *Report of the Committee on Photometry.*—This paper contains a description of a series of experiments made at Frankfort-on-the-Maine, with the view to enable the gas-works' managers throughout Germany and some adjoining countries to adopt a general plan of making photometrical tests of the gas they manufacture. From this report, we learn that the use of glycerine, instead of water, in wet gas-meters is attended with some danger, owing to the fact that, after a length of time, the glycerine appears to attack the metal working parts of the meter, and give rise to leakage. The quantity of gas consumed last year in Paris amounts to 138,797,811 cubic metres; this figure has to be multiplied by 35·3165 to convert it into English cubic feet.

Les Mondes, August 19, 1869.

This number contains:—

The Electrical Machine of Holtz.—Dr. P. J. Kaiser, the celebrated astronomer and physicist, of Leyden University, and his equally eminent colleague, Professor Ryke, have been not only experimenting with this instrument, but have very much improved its construction, and thereby largely increased its efficacy. We regret that we cannot enter into details on this subject, owing to the fact that, for the proper understanding the woodcut annexed to the original would have to be reproduced.

Theoretical and Practical Studies on the Divers Processes in Use for the Purification (Defecation) of Beet-Root Saccharine Juice by means of Lime and Carbonic Acid.—M. Feltz.—This paper treats, at length, on a subject of considerable importance to the parties more immediately interested, beet-root sugar manufacturers. There is added to it a very precise description of the different methods of estimating the quantity of lime contained in the clarified juice, and, also, divers processes for the quantitative estimation of the organic matters, other than sugar, contained in the said juice. The paper is too long, however, for useful abstraction, and is to be continued in following numbers of this periodical.

We learn from this number that two scientific men of great name in their time have died at an advanced period of life—Prof. Purkinge, of Prague, died on the 24th of July last, aged eighty-two years; Dr. Carus, of Dresden, born in 1789, died also a few weeks ago.

August 26, 1869.

This number contains the following original article:—

Theoretical Chemistry.—M. Maumené.—The author's chief object is to prove that chemists should avail themselves of the author's "Théorie Générale de l'Action Chimique"; and, in order to exhibit it, the author refers to M. Schutzenberger's recent discovery of hydrosulphurous acid. Hydrosulphite of soda, $NaO.S_2O_2H$, when exposed to heat, after having been carefully dried, yields a little water, sulphur, and sulphurous acid, and leaves a residue consisting of sulphate and sulphuret of sodium. The author of this paper puts the question, Why hydrosulphite of soda should give, under the influence of heat, all the products just enumerated? Why should we not have a more simple action? as, for instance—

$$NaO.S_2O_2H = NaO.SO_2 + HS,$$

or—

$$= NaO.SO_2 + HO + S.$$

Every impartial chemist will at once admit that not one of the hypotheses at present current in the science of chemistry can serve to explain this. My theory exhibits precisely why these more simple actions cannot take place, and why all the bodies observed to be formed by M. Schutzenberger, must of necessity be formed. When a salt is submitted to the action of heat, the acid and base of that salt only constitute, during the action of the heat, a simple mixture acting by equal weight. For one equivalent, E, of one of these two bodies (that is to say, that which has the highest equivalent), the number, *n*, of the equivalents, E′, of the other body (that the equivalent of which is the lowest) is expressed by the general formula—

$$n = \frac{E}{E'}$$

We have, therefore, in the present instance—

$$n = \frac{57(S_2O_2H)}{31(NaO)} = 1·84$$

that is to say, that the equivalent of the acid S_2O_2H, at the moment that the heat becomes strong enough to cause its dissociation from the soda, acts upon 1·84, say, nearly two equivalents of soda. We have, therefore—

$$2NaO + S_2O_2H = NaO.SO_3 + NaS + HO.$$

This first action is followed by a second; one-half of the acid was free; it has, by itself, been exposed to the action of the heat, and gave—

$$S_2O_2H = SO_2 + S + HO.$$

The total result of the decomposition is, therefore, the sum of the equals—

$$2NaO.S_2O_2H = NaO.SO_3 + NaS + SO_2 + S + 2HO,$$

as observed by M. Schutzenberger.

Cosmos, August 21, 1869.

This periodical contains, among other interesting matter :—

Description of the Self-Registering Instruments used at the Kew Meteorological Observatory.—Messrs. R. and J. Beck.—The editor of this paper states that, since these well-known eminent instrument makers are amongst his subscribers, he has been favoured with the excellent woodcuts and description given by the makers of the instruments.

Discovery of Coal.—On the eastern shores of the Caspian sea, abundant seams of coal have been found. The steam-ships navigating on that sea have hitherto used wood as fuel, which had to be carried far away from the Ural mountains, at great cost. The coal is of very good quality. More than forty years ago, the late A. von Humboldt stated his belief that coal would be found in this region at no great depth under the surface of the ground, since this entire locality abounds in naphtha.

Pharmaceutische Zeitschrift für Russland, May, June, and July, 1869.

These three numbers of this periodical have been published simultaneously, and are, therefore, taken together. The leading article, commenced in the May number, and continued through the two others, is a lengthy monograph on the following subject :—

Best Method of Preparation and Constitution of Hyoscyamine, and the relation this Alkaloid bears to the Quantity of Nitre (Nitrate of Potassa) contained in the Plant wherein the Alkaloid occurs.—M. Thorey.—The author divides this paper into three sections, respectively headed—On the preparation of hyoscyamine; the constitution of that substance; and its relation to the quantity of nitre the plant which yields it contains. The preparation of this alkaloid is described by the author with full details, as given by the very large number of chemists and pharmaceutists who have worked on this subject. Among the various methods of preparation of this alkaloid devised by the author, we notice the following :—50 grms. of *Semina hyoscyami nigri* (common henbane) are ground to powder, exhausted with 150 grms. of alcohol (85 per cent strength), and the alcoholic tincture concentrated by distillation, one-half of the bulk of the alcohol being distilled off. The residue left in the retort is next mixed with water, filtered, reduced, by evaporation, to about 30 grms., and then again filtered. The filtrate is mixed with a solution of caustic potassa, after having been previously heated to 40°, next treated with chloroform, the chloroformic solution washed with water, until that fluid runs off quite clear, and the solution thus obtained evaporated to dryness, leaving 0·0835 grm. of a yellowish mass smelling like tobacco. This mass is re-dissolved in weak hydrochloric acid, filtered, carefully saturated with caustic potassa, again treated with chloroform, this solution again washed with water, and, at last, left to spontaneous evaporation over sulphuric acid, yields well-crystallised hyoscyamine. The alkaloid thus obtained is a quite pure, colourless substance, of bitter taste, readily soluble in dilute alcohol, in ether and chloroform, in benzine and amylic alcohol, and dilute acids. Among its characteristic chemical reactions, belongs a red amorphous precipitate, with the double iodide of bismuth and potassium; a yellow precipitate, gradually verging on blue, when left standing with phospho-molybdate of soda; a flocculent yellow precipitate with chloride of gold, which, after a time, becomes crystalline; a deep kermes red colouration with aqueous solution of iodine; and an amorphous yellowish grey precipitate with tannic acid. During his researches on this subject, the author has discovered that henbane contains, in addition to hyoscyamine and saltpetre, a peculiar resinous substance, and an acid. The resinous material is remarkable, since it contains nitrogen, its percentical composition being—C, 67·67; H, 8·772; N, 3·508; O, 20·05. As regards the constitution of hyoscyamine, the author says it is, at present, not easily possible to control the statement made by M. Kletzinsky, that this alkaloid should be the nitrile of santonate of ammonia. The question, What relation the hyoscyamine bears to the quantity of saltpetre contained in the plant which yields it? is treated at great length; but it is difficult to give any brief *résumé* of these researches, which are recorded in several tabulated forms full of figures. All parts of the henbane contain a considerable quantity of nitrate of potassa; and it appears that, while that quantity varies at various periods of the growth of the plant, so, also, varies the quantity of hyoscyamine contained in the various parts of the plant. The quantity of hyoscyamine contained in the leaves of the plant dried at 110°. and taken before the blooming period, varies from 0·023 to 0·208 per cent. The seeds contain from 0·048 to 0·160 per cent of hyoscyamine.

The Saline Deposits of Turkestan.—M. Palm.—The author says that he was sent on a long journey through a very little frequented portion of the Asiatic part of the Russian empire, and that, during that time, he studied especially those saline deposits which are not chiefly composed of common salt, known by the German name of *salz-steppen*. The first deposit alluded to in this paper is met with near Fort Perowski, and consists of alternate layers of a saline mass and fine white sand, impregnated with a salt soluble in water. As instances of the composition of this salt, we quote the following analysis from this paper:—Percentical composition—NaO, 42·4; SO_3, 54·8; water, 2·0; sand, 1·0. Sulphate of soda, 47·215; common salt, 2·719; water, 48·50; sand, 1·566; formula—

$$NaO,SO_3 + 8\,aq. + 1\text{-}14th\ eq.\ NaCl.$$

Sulphate of soda, 57·26; common salt, 10·18; water, 35·56; formula—

$$10(NaO,SO_3) + 2(NaCl) + 9HO.$$

The author describes, very minutely, these deposits, and a number of others, stating that several millions of tons of sulphate of soda are deposited in this far away region, inhabited only by a few Nomadic tribes, and by the Cossacks, who do duty along the great roads as a military police.

Very Black and Very Cheap Ink.—M. R. Voigt.—Take 12 ozs. of extract of logwood, 1¼ lbs. of best nutgalls, 1 lb. 6 ozs. of dried sulphate of iron (*sulphas ferri ustum*), 1 lb. 1½ ozs. of senegal gum, 1 oz. of commercial sulphate of copper, ½ a drachm of corrosive sublimate, and 45 lbs. of water. The nutgalls, previously ground to a coarse powder, are macerated for four days with 12 lbs. of previously well boiled, and afterwards quite cooled, water, taking care to place the mixture in a cool place. The extract of logwood is also dissolved by itself in 12 lbs. of the same water; the previously dried sulphate of iron is dissolved by itself in 5 lbs. of that water; the sulphate of copper is, also, separately dissolved in ½ a lb. of water. The quantity of corrosive sublimate is, likewise, separately dissolved in 4 lbs. of the said water, while the gum is dissolved in 9 lbs. of that same fluid. Each of these solutions should be filtered, either through a very fine hair sieve, or through linen; and, after that, the solutions should be mixed together in the same order as they are here enumerated. The ink thus obtained should be bottled, and the bottles, after having been well corked, kept in a cool place. 1 lb. of this ink can, according to this author, be had for the low price of 6 kopéiks (about three farthings).

Comparative Study on the Characteristics of the Halogens and their Combinations, and especially, also, on Hyperiodic Acid.—Dr. Ferrein.—This monograph contains the history of the halogens (chlorine, bromine, iodine, fluorine), treated at length, from the earliest days of Lavoisier and Scheele up to the present time. The essay is too lengthy for any useful abstraction.

On Mercurialin.—M. Reichardt.—The preparation of this substance from the *Mercurialis annua* is given at great length; it is a complicated process, requiring great nicety of manipulation. Mercurialin is an oily fluid, at first colourless, but readily becoming brownish tinged by the action of heat, as well as by simple contact with air; it is an alkaloid, exhibiting a strongly alkaline reaction to test paper. The formula of mercurialin, as deduced from its salts, is $C_9H_{13}N$. The author has studied a series of the salts of this substance, most of which salts crystallise, and some are capable of forming well-defined double salts.

Steam-Boiler Incrustations.—M. E. Wiederhold.—The author states that the hardest incrustations of this kind are formed when the quantity of carbonate of lime amounts to from 20 to 25 per cent of the entire mass. He has found, by an experience extending over several years, that some kinds of clay, among these, the substance known as *kieselschiefer* (a peculiarly fatty clay), when suspended in the water contained in steam-boilers, prevent the particles of carbonate and sulphate of lime dissolved in the water, even if the latter is very hard, to cling together, and become fixed to the sides of the boilers, forming there a hard incrustration. A series of experiments, made on purpose, and continued for a sufficient length of time to yield a reliable result, has fully proved that the addition to the feed-water of the steam-boilers of fatty clays, especially the kind known as fuller's earth, entirely prevents boiler incrustations, even where, of necessity, very hard water has to be used as feed water. A loose, soft mud is deposited as soon as the motion of the water, due to the boiling, ceases on cooling. This mud readily runs off on opening the sludge-valve of the boiler.

Zeitschrift für Chemie, von Beilstein, No. 14, 1869.

This number contains only two original papers :—

Reduction-Products of Mononitroazoxybenzol.—G. A. Schmidt.—It appears that the author had been engaged with researches on this subject some eight years ago, but had not then gone very deeply into it. Meanwhile it was taken up by various other experimenters, and among them, also, M. Alexejeff, who wrote and published a monograph on this subject in the Russian language. This circumstance induced the author to resume his work; and he proceeds with the reduction of the nitroazoxybenzol as follows :—One part, by weight, of that material is dissolved into ten parts of strong and boiling alcohol. While boiling temperature is kept up, there is gradually added a strong alcoholic solution of sulphide of ammonium, in small quantities of from 2 to 3 c.c. at once, and this is continued until all nitroazoxybenzol is dissolved, and none of it appears to crystallise out on a few drops being taken out of the boiling fluid as a test and cooled down. The formation of aniline and β phenyldiamin is in this way entirely prevented. To the liquid, after having been decanted from the precipitated sulphur, a mixture of weak spirit and excess of hydrochloric acid is added, whereby muriate of amidoazobenzol is formed; this is a solid substance, exhibiting crystalline form, and possessed of a violet-blue colour and metallic lustre. When to these yet impure crystals is added a little ammonia and weak spirit, there is obtained

a golden yellow-coloured crystalline mass, insoluble even in boiling water, but readily soluble in alcohol and ether; this pure material fuses at 127°. This muriate, or hydrochlorate, yields, on being treated with excess of ammonia, the amidoazoxybenzol, a solid substance fusing at 138·5°, composed according to the formula $C_{12}H_8(NH_2)N_2O$, nearly insoluble in cold water, a little soluble at the boiling point of that fluid, and readily soluble in strong alcohol, ether, and benzol.

On Trinitroazoxybenzol.—G. A. Schmidt.—When azoxybenzol is treated with a mixture of nitric and sulphuric acids, a trinitro product is obtained. The author mixed, in a flask, 20 grms. of azoxybenzol with 200 grms. very strong nitric, and 100 grms. of concentrated sulphuric acids. The azoxybenzol dissolves without giving off red vapours (but, becoming very hot, the mixture is to be poured into cold water immediately), and yields a bright yellowish crystalline mass, glued together by a resinous product. After having rubbed up with some water, and placed on a filter, washed, and dried, the resinous matter is dissolved, and thereby the trinitroazoxybenzol obtained as a crystalline powder, insoluble in water, very difficultly soluble in alcohol and ether, and readily soluble in benzol. It is best purified by re-crystallising it from nitric acid of 1·38 sp. gr., wherein it is readily soluble on being boiled, and crystallises on cooling. It fuses at 152°, solidifies at 140°, and explodes rather sharply when heated more strongly. Formula, $C_{12}H_7N_3O_7$. The resinous matter referred to contains binitroazoxybenzol, or isomeric substances, researches about which still occupy the author.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1683. H. Holdrege, New York, U.S.A., "Improvements in the process of making gas for illuminating, heating, and other purposes, and in apparatus for the manufacture thereof."—Partly a communication from W. H. Gwynne, New York, and G. W. Harris, Elizabeth, New Jersey, U.S.A.—Petition recorded May 31, 1869.

2039. W. Pidding, Lambeth, Surrey, "Improvements in the mode or modes of obtaining scents, aroma, perfume, or essential oils, from flowers and from all vegetable substances producing the same; also in the machinery or apparatus in connection therewith."—July 6, 1869.

2328. J. T. Way, Kensington, Middlesex, "Improvements in the manufacture of soap, and in cleansing wool and woollen goods."—August 3, 1869.

2345. E. Beanes, Cordwalles, near Maidenhead, Berks, "Improvements in preserving articles of food."—August 5, 1869.

2413. D. Barker, Northfleet, Kent, "Improvements in the manufacture of artificial fuel."—August 12, 1869.

2418. D. A. Gibbs, Milton Street, London, "Improvements in compositions for coating or covering the sides and bottoms of ships and vessels."—August 13, 1869.

2431. W. Matt, Homerton, Middlesex, "An improved compound, or composition, in imitation of marble, veneer, and other substances, to be used in the manufacture of fancy and other articles."—August 14, 1869.

2440. H. Pinkus, Camden Town, Middlesex, "Improvements in furnaces and other heating apparatus, and in the methods of applying and using therewith certain elements of combustion, and in the combinations therewith of the processes, with materials to be used in the manufactures of metals, and other things and uses, and in the mechanical constructions necessary therefor."

2443. J. G. Dale and E. Milner, Warrington, Lancashire, "An improved method of producing white pigments from lead."—August 16, 1869.

2482. F. Braby, Euston Road, Middlesex, "Improvements in the means and apparatus for the manufacture of caustic ammonia and ammoniacal salts."—August 19, 1869.

2490. W. Byrne, Belfast, Ireland, "Improvements in the process of distilling alcoholic liquors, and in apparatus for that purpose.

2493. A. V. Newton, Chancery Lane, "An improvement in the process of manufacturing paint."—A communication from S. R. Bradley, New York, U.S.A.—August 20, 1869.

2500. P. A. Blake, Highbury, Middlesex, "A new or improved safety explosive compound or compounds to be used for blasting and other purposes, together with means connected with its use."—August 21, 1869.

2503. T. Gibb and C. Gelstharp, Jarrow-on-Tyne, Durham, "Improvements in the extraction of copper from its ores."—August 23, 1869.

NOTICES TO PROCEED.

1224. M. Henry, Fleet Street, London, "An improved mode of obtaining pyrophosphate of lime."—A communication from E. Deligny, Boulevard St. Martin, Paris.—Petition recorded April 21, 1869.

1290. S. Oakman, Boston, Suffolk, Mass., U.S.A., "Improvements in the construction of smelting and other furnaces."—April 26, 1869.

1380. W. Mackean, Paisley, N.B., "Improvements in the manufacture of cattle food."—May 5, 1869.

1486. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of beet-root and other pulps, and in machinery or apparatus employed therein."—A communication from H. Champonnois, Paris.—May 14, 1869.

2364. W. E. Newton, Chancery Lane, "An improved process for purifying or disinfecting alcohol and alcoholic liquors."—A communication from E. J. Maumené, Paris.—August 7, 1869.

2409. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of iron and steel."—A communication from J. J. Johnston, Allegheny, Penn., U.S.A.—August 11, 1869.

2501. J. Baur, New York, U.S.A., "Improvements in the manufacture of steel."—August 21, 1869.

NOTES AND QUERIES.

Solid Chloride of Carbon.—Could you kindly inform me of the method for preparing the solid chloride of carbon mentioned in the CHEMICAL NEWS (vol. xx., p. 130)? Could it be made from the tetrachloride of carbon?—H. BUTT.

Sulphate of Ammonia and Sulphuric Acid.—Can any of your readers inform me of a ready commercial method of determining the percentage of ammonia in sulphate of ammonia, and also tell me the readiest way to find out if pyrites has been used in the preparation of vitriol?—A. Z.

Gas Furnace.—Will any of your readers inform me if it is practicable, by means of an ordinary chimney draft, and gas from the main, to get up a white heat within a cylinder of some 2 ft. diameter and 4 ft. high (the cylinder would be fitted inside with objects for flame to strike against)? If so, I should feel much obliged.—J. C.

Simple Experiment Showing that Air Possesses Weight.—Heat a little water in a flask until the air is purged out, and, while in this state, cork tightly, and set aside to cool. When cool, balance carefully in a good balance, or even ordinary scales; then remove the cork to admit air, and again weigh (including cork): the additional weight of air admitted into the flask will be sufficient to sensibly turn the scale.—W. NETTLETON, Huddersfield.

Terra Alba.—In answer to "Terra Alba," this article is not an artificial product, but the finest quality of gypsum stone that can be had, carefully ground to a powder. It is made principally in Derbyshire, and at Leith; it is used for many purposes; it never varies in quality, except according to the quality of the stone it is made from. There is an artificial terra alba, sold under the name of pearl hardening, and which is chemically the same, made by precipitation, under the patent of M. Jullien. It contains a larger quantity of water than the natural article. If it is too much dried, it is liable to lose part of its water of crystallisation, and, on addition of water, to set hard like plaster. If your correspondent applies to me, through you, I will give him every information he needs.—NEMO.

Octylic Alcohol.—In reply to your correspondent G. P. Clark, I beg to inform him that the best method of preparing octylic alcohol from castor-oil is the following:—Dissolve one part of caustic potash (or soda, which will do quite as well) in a small quantity of water, add two parts of castor-oil, and heat this mixture in a large iron pot until all frothing ceases, and a smell of mushrooms is given off. Introduce the solid mass thus obtained into the still, and conduct the distillation as quickly as possible. To purify the crude alcohol, it has to be rectified several times over fused caustic potash, the portion boiling below 200° C. only being collected. Besides higher boiling products, hydrocarbons having a lower boiling point are also present, and are easily removed by fractional distillation. Instead of using castor-oil, castor-oil soap may be used, which has first to be heated with caustic alkali, in an open vessel, as described above.—C. SCHORLEMMER, Owen's College, Manchester, September 11th, 1869.

TO CORRESPONDENTS.

*** It is our pleasing duty to accord our best thanks to those gentlemen who have so kindly acceded to our request in sending us the necessary information respecting the Chemical and Medical Schools for our Students' Number.

J. Cubitt.—You will find full particulars on the subject you name in Watts's "Dictionary of Chemistry," vol. v., p. 276.

L. W. Longstaff.—Dr. Roscoe's new work on spectrum analysis, published by Macmillan, is the most complete work on the subject.

W. Carslon.—Consult "Annaire Almanach de Commerce, de l'Industrie, de la Magistrature, et de l'Administration, ou Almanach des 500,000 adresses (Didot-Bottin), 72e année, 1869." You can see this work at the library of the Patent Office, and possibly at one of the libraries, or the French Consulate Office in Edinburgh.

W. Seddon.—(1) A number of works on this subject have been published; amongst them we may name "A Treatise on Coal and Coal Mining," by W. W. Smyth, M.A., F.R.S., &c. (Virtue); "Coal and Coal Oil," by Eli Bowen, Philadelphia, U.S. (Burat La Houille, Paris): several editions of this work have appeared. (2) Galvanic batteries are made so cheaply by philosophical instrument makers that it is scarcely worth while to make them; but any work on natural philosophy will give you sufficient information about their construction.

BOOKS RECEIVED.

Transactions of the Epidemiological Society of London, Vol. III., Part I. London: Hardwicke.

Canterbury Water Supply: Chemical Report. By Dugald Campbell, Esq., F.C.S. 1869.

American Reprint of the CHEMICAL NEWS for September, 1869.

Treatment of Human Excreta. By J. C. Lee. Manchester: J. Heywood.

THE CHEMICAL NEWS.

Vol. XX. No. 514.

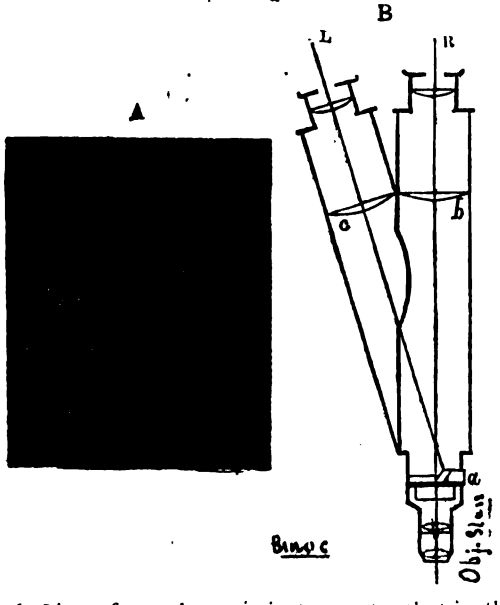
ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 149.)

A description of the compound achromatic microscope can, at the present time, hardly be considered complete without some mention of binocular instruments. The binocular principle had been applied to opera glasses with great success for many years. More recently the invention of the stereoscope and its great popularity drew increased attention to the subject of binocular vision, but until a few years ago no attempt seems to have been made to adapt the principle to microscopes. Owing to the short focal length of microscopical objectives, the use of two convergent instruments would of course be impracticable; the only resource was to divide the pencil proceeding from the object-glass and convey half to each eye. The earlier attempts resulted in the

Fig. 11.†



production of pseudoscopic instruments; that is, the relative positions of the object viewed were reversed projections, being represented by depressions and the contrary. This was found to be caused by the rays of light being conveyed to the wrong eyes, the right side of the image entering the right eye, and the left the left eye, the effect being that of a wrongly mounted stereoscopic picture. It was found necessary that the right-hand image should be conveyed to the left eye, and *vice versa*, to produce a stereoscopic effect; this was accomplished by M. Nachet of Paris, and Mr. Wenham by different methods, each having their respective merits. As Mr. Wenham's is most in use in this country, I will briefly describe it. A four-sided prism of peculiar form (Fig. 11, A) is placed in the body of the microscope, just behind the posterior combination of the object-glass (Fig. 11, B, *b*), which, when in position, it half covers. An additional body, L, is joined at a slight inclination to the left-hand side of the instrument, and the two bodies are furnished at their upper extremities with draw-tubes, which supply the means of making an adjustment for the varying distance between the eyes of different persons. The image formed by the left-hand half of the objective passes up the straight tube to the right eye without being in any way interfered with by the prism; the right-hand image falls on the prism, is twice reflected, and passes into the left-hand inclined tube, and in this simple manner the crossing of the images from the two sides of the objective is effected, only one-half of the pencil suffering any reflection at all, besides giving the great advantage of instantly converting the instrument into a monocular by simply withdrawing the prism. It is only due to Mr. Wenham to mention that he has, with most praiseworthy liberality, granted free and unconditional use of his valuable invention to the public.

The binocular arrangement of Mr. Wenham cannot be used with advantage with objectives of less than half an inch focal length, but several arrangements have been constructed by which both eyes can be employed in high power observations, the most noteworthy of which has been brought forward by Messrs. Powell and Lealand. This instrument does not produce any stereoscopic effect, but nevertheless greatly diminishes the fatigue of protracted observations. A still more perfect adaptation has been constructed by Mr. Wenham, in which the light in each tube has been more nearly equalised than in preceding instruments.

The stereoscopic binocular offers many advantages over the monocular instrument, not the least of which is the saving of the fatigue to the eyes from which most persons suffer in a greater or less degree when using one eye for observation. Did the binocular arrangement do no more than this it would be a great boon, but it has the valuable property of enabling the observer readily to estimate the amount of elevation and depression of the surface he is viewing, and accurately to determine the relative position as to depth of the various parts of the tissue under observation. The discoveries which we owe to this improvement of the microscope have been numerous and valuable; among the earliest were some interesting observations on the circulating system of the tadpole, by Mr. W. U. Whitney (*Trans. Micros. Soc. Lond.*, vol.. x.. 1862, p. 1; and vol. xv., p. 43). Several also by the late Richard Beck; among them the re-discovery of the aperture in the fang of the spider figured by Leeuwenhoek (Hoole's English Translation, vol. i., Pl. 2, fig. 19) (*Science Gossip*, 1866, p. 201).

By a slight variation of the form of the prism, Mr. Crouch has succeeded in constructing a microscope which can, by merely shifting the position of the prism, become stereoscopic or pseudoscopic at pleasure. This modification of the binocular will probably be of value in confirming certain doubtful points of structure, by giving a reversal of the parts in relief.

Further particulars respecting the construction of

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

† "The Microscope and its Revelations," by W. B. Carpenter, M.D., Figs. 19 and 20 (Churchill).

the microscope and the optical principles involved will be found in the "Microscope and its Revelations," by Dr. Carpenter, and "Manual of Natural Philosophy" by Mr. Charles Brooke.

The microscope being a costly instrument, it is necessary that great care should be taken to preserve it from injury. When out of use it should be returned to its case or may be conveniently covered with a large shade or bell-glass. The eye-pieces should be carefully cleaned, as dust upon them becomes very apparent. The object-glasses, if kept in their boxes when out of use, will seldom require much cleaning; dust on the object-glass only causes a slight loss of light, but does not make itself visible. The best material for cleaning lenses is a piece of very soft wash-leather from which all dust has been beaten out; it should be kept in a large pill-box when out of use to preserve it from dust and grit, and should on no account be used for any other purpose, such as cleaning the brass-work of the instrument. Should the object-glasses require anything beyond mere dusting, they should be placed in the maker's hands as they are liable to injury if taken to pieces by inexperienced persons.

The sources of light for the purposes of observation will need a few remarks. When it can be procured, daylight is in every respect to be preferred to artificial sources of illumination, as by it alone can colours be perfectly seen and distinguished, and daylight observations are far less fatiguing than those made by lamp-light. Direct sunlight should be avoided, and, if possible, the light taken from a white cloud. But in towns, as the sky is seldom visible, and, moreover, few persons have much time to observe by daylight, it becomes important to seek for a good source of artificial light.

Gas has been used by many microscopists; it has the disadvantage of giving out a large amount of heat, and the quality of the light is inferior to that obtained from most other sources; its sole advantage is its convenience, as it is always ready for use, and requires no trimming, as is the case with lamps.

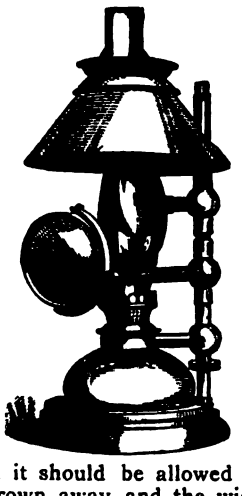
Well constructed lamps burning colza oil give a light of good and pure quality, although not as intense as those presently to be described. The best oil lamp I have used was obtained from Mr. Pillischer, and was only abandoned for the very intense camphine lamp. Oil-lamps require great care in trimming and cleaning, otherwise they will not burn well.

The mineral oils (paraffin, belmontine, &c.), when of good quality, and consumed in properly constructed lamps, are among the best of the microscopist's means of illumination. The quality of the light is good, and there is very little trouble required in keeping the lamp in good working order. The glasses, as in all lamps, should be kept clean, otherwise much light is lost, and to obtain the best possible effect the lamp should be trimmed each time of using, although it will burn very well two or three times without any attention. The best way of obtaining a good oil is to try small samples from various shops, and when a good one is found keep to its use. The burner exercises a very great influence upon the light, so great that in a series from various makers it would hardly be supposed that they were burning the same oil. The burners of American make supplied by Mr. Collins with the Bockett microscope lamps (Fig. 12), are some of the best that I have met with. This lamp has recently been improved by the adaptation of a metal chimney which is not liable to breakage, and also has the advantage of protecting the eyes of the observer from the light.

The best light of all for those who do not mind the slight amount of trouble attending its use is obtained from the combustion of camphine or highly rectified spirits of turpentine in a small lamp, especially constructed for the purpose by Mr. W. Young. The light is much whiter and more intense than that of any other lamp; owing to this quality the flame can be very much reduced in size, and most of the heat of a large lamp avoided, a matter of importance where the lamp is often placed near and below the face of the observer.

Camphine, when not used quickly, should be kept in small bottles, filled up to the neck, and closely corked, and kept in a cool place—a wine-cellar answers admirably. For the small consumption of the microscope lamp the bottles should not exceed four or five ounces, as the spirit rapidly deteriorates by exposure to the air both from evaporation and the absorption of oxygen, which renders it liable to clog the wick and reduces its illuminating power. The wick should be cut very exactly to a level, far more carefully than would be required for oil or paraffin, the least uneven point rendering the lamp liable to smoke. No more camphine than is likely to be consumed should be placed in the lamp; if there is more than is needed it should be allowed to burn itself out, or be thrown away, and the wick allowed to burn dry, otherwise the lamp is liable to become clogged, and burn badly. Should any part of the lamp become incrusted with a resinous deposit, it must be cleaned with methylated spirit; care should be taken that none of the air passages are obstructed. Although these precautions may seem troublesome, they really are not so to persons willing to acquire the habits of neatness so necessary to those who would make good microscopists; and the slight extra trouble is amply compensated by the superior purity and intensity of the light and its extreme cleanliness, it being perfectly free from greasiness or disagreeable smell. As the lamp is always kept empty it is very convenient for carrying about when it is necessary to make observations away from home.

Fig. 12.



The illuminating apparatus commonly supplied with microscopes consists of the mirror below the stage, and a condensing lens either attached to the instru-

ment or, as is to be preferred, on a separate stand. Other apparatus will be described in subsequent chapters.

The mirror is used for illuminating objects by directing light through them from beneath the stage, and is the usual, although not always the best, means of lighting an object, as it is one which we are unaccustomed to, and, without special precautions, is likely to lead into error. The mirror is capable of being moved out of the axis of the instrument, and light may be directed very obliquely upon the object, which is sometimes advantageous.

The condensing lens is used to concentrate light upon the object from above, and, when it can be employed, it is always preferable to commence an observation in this way rather than by means of transmitted light, as it accords more closely with our every-day way of viewing objects: it is not our usual custom to hold up a substance we wish to examine and try to look through it, but we generally allow the light to fall naturally upon it. If a plano-convex lens, or "bull's-eye," be used as a condenser, it is necessary to be careful which side is turned to the source of light, otherwise it may be used in a position causing a great amount of spherical aberration and consequent loss of light. A plano-convex condenser should always have its curved side turned to the source of light when used for concentrating light upon an object. When used for rendering divergent rays, such as those of a lamp, parallel, which is often required when using apparatus hereafter to be described, the bull's-eye should be placed with its flat side to the lamp and at about the distance of its focal length.*

The beginner is recommended to commence his observations by endeavouring to procure a good and brilliant illumination with the condensing lens, looking at any easily procured objects, such as fragments of paper, feathers, sand, &c.; a hummingbird's feather or wing of a butterfly is particularly useful, as either of them presents very different appearances, according to the direction of the illuminating pencil, the iridescent colours of the first and the imbricated structure of the second not being seen unless the light is made to fall in the proper direction. The light should be moved or the object turned round, and the varied appearances carefully noted. This precaution should be adopted with all objects viewed by reflected light.

In commencing observations by transmitted light, the student may profitably examine air-bubbles in water, easily procured by shaking up a little very weak gum-water in a bottle, and also globules of oil in water, of which milk furnishes a good and readily-procured example. A little of each of these should be placed on a separate slide, covered with a thin glass and examined by transmitted light, the air-bubbles with an inch objective; the milk may probably require a ½ or ¼.

The leading characteristic of the air-bubble is its broad black margin when examined by transmitted light. If the laws of refraction are considered, it will be evident that a bubble of air in water will act precisely as a double concave lens, Fig. 4, B, and by its dispersive power scatter the rays of light, especially at the part where its power is greatest—the margin. The same effect may be produced, on a large scale, by holding to the light two plano-concave lenses of glass with their hollow sides placed together; this will almost exactly represent the air-bubble in water, differing only in the glass having a greater refractive power than the water in the microscopic slide, and dispersing the light rather more powerfully.

The oil globules of the milk exhibit a brilliant spot of light in their centre when slightly beyond the focus of the microscope; this is owing to their being more refractive than the surrounding medium: their action is that of double convex lenses, Fig. 4, A, and the bright spot is an imperfect image of the source of illumination, which is rendered visible when the focus of the microscope coincides with that of the globule, which will be when the instrument is slightly above the focus for distinct vision of the globule.

These appearances should be carefully studied and remembered, as bubbles of air are among the most frequent of the instrusive substances to be met with during microscopical observations; cells filled with oil and globules of oil are also of frequent occurrence in tissues. Besides these, the student should make himself acquainted with the microscopical appearance of fibres of cotton, wool, flax, &c., hair of cats and other animals, all of which are frequently found in the dust of our apartments, and of course in our microscopical preparations, unless more than ordinary care is taken to prevent their intrusion, so that it is well to know them that they may not be mistaken for characteristic portions of the substance under observation, a not unlikely error on the part of inexperienced observers.

A sample of dust from the walls of an office in the Bank of England, where it had accumulated for more than ten years, consisted of about one-half cotton fibre, probably derived from abrasion of paper; the remainder consisted of fibres of wool and flax in small quantities, and soot and grit; molecular motion was apparent when examined in water with a power of 400 diameters. An interesting paper "On the Microscopical Examination of Dust" was read by Mr. J. B. Dancer before the Literary and Philosophical Society of Manchester, January 26th, 1869.

(To be continued.)

* Each lecture was followed by a practical demonstration, during which various objects, &c., were examined and processes in manipulation carried on under the superintendence of the lecturer and assistants. Much of the subject-matter of these demonstrations will be incorporated with the text; such portions as cannot be so given will be added at the end of the various chapters.

ON THE

DETERMINATION OF CRYSTALLISED SUGAR.

By JAMES BELL, Esq.

Two processes for the determination of crystallised sugar have been proposed, one by M. Dumas, and the other by M. Payen. Both methods are based on the insolubility of crystallised sugar in alcohol saturated with refined white sugar, while inverted and uncrystallised sugars are supposed to be soluble therein.

These two processes, while differing in many important particulars, are essentially the same in the method followed in liberating the crystallised sugar, which consists in mechanically washing out, by simple agitation, the inverted and uncrystallised portion. This method of operation may be adapted for the analysis of superior qualities of sugar, but it is not applicable to low descriptions, such as "jaggery" and "concrete," or to mixtures of sugar and treacle.

In the analysis of "jaggery" and "concrete," &c., simple [illegible] liquor is not sufficient to dissolve [illegible] of the inverted and un-

crystallised sugars, and liberate the crystallised portion. When the proportion of inverted and uncrystallised sugars present is tolerably large, the sample possesses a considerable degree of tenacity, and, it is not practicable, by simple agitation, to reduce it into that minutely divided state which is essential to admit of the solvent power of the test liquor being brought into full action; and in practice, in order to effect a complete disintegration of the sugar, it is necessary to operate in a mortar, and to gently rub the sample in the test liquor with a pestle.

The alcohol employed in both Dumas's and Payen's processes is of a strength of 85°, or a little under 50 over proof strength, and, prior to saturation, there is added to the alcohol five per cent of acetic acid, for the purpose of decomposing and dissolving any salts of lime, &c., that may be present.

Before submitting the sample to the action of the test liquor, M. Payen removes the "2 or 3 per cent" of moisture it contains by "absolute alcohol." It is obvious that this could not be done with samples containing large percentages of treacle, such as those to which the process hereafter described is applicable, as the "absolute alcohol" could not abstract the water from them, on account of their viscidity, and even if it were possible for it to do so, the reduction in strength would be so considerable that the alcohol would have a very appreciable solvent action.

The strength of the alcohol has a very important influence upon the accuracy of the result, and, while it is desirable to keep the strength as high as possible, that the alcohol may be readily saturated with a small quantity of crystallised sugar, and that a slight reduction in strength will not materially increase its solvent power, it is, on the other hand, essential that the alcohol should be of such a strength that the proportion of the test liquor used for washing the sample will be sufficient to dissolve the whole of the inverted and uncrystallised sugars present.

Alcohol, at the higher strengths, has a very limited solvent power for sugar; but its power for dissolving the sugar increases in a greater ratio than its reduction in strength. For example, at a temperature of 60° Fahr., 100 grains of alcohol by measure of the respective strengths of 62·6, 55·7, and 49·6 over proof dissolve 0·52, 1·34, and 2·94 grains of crystallised sugar respectively. It will thus be seen that, from 62·6 to 55·7 over proof, a reduction in strength of 6·9°, the solvent power of the alcohol is increased by only 0·82 of a grain, or 0·12 of a grain for each degree of reduction in strength, while from 55·7 to 49·6 over proof, a reduction in strength of 6·1°, the solvent alcohol is increased 1·60 grains, or 0·26 of a grain for each degree of reduction, being more than double the ratio of the increase from 62·6 to 55·7 over proof.

In like manner, the solvent power of alcohol for inverted sugar increases with its reduction in strength, but not in an increasing ratio, as in the case of crystallised sugar; on the contrary, the ratio of increase appears to be a diminishing one.

It is necessary to bear these facts in mind in selecting alcohol of the most suitable strength for preparing the test liquor. If the alcohol be of a very high strength, the result will show a higher percentage of crystallised sugar than is known to be present; but, on the other hand, if the alcohol used be of a very low strength, there will not only be considerable difficulty in fully saturating it with cane-sugar, but the result will be a much less proportion of crystallised sugar than there should be.

This may be illustrated by the following results obtained from experiments, made upon the same mixture of refined sugar and treacle, with test liquors prepared from alcohol at each of the strengths specified.

	Percentage of crystallised sugar.
1. Alcohol of 40 over proof gave	49·20
2. „ 56 „ „	54·49
3. „ 63 „ „	64·70

The result obtained in No. 2, by alcohol of 56 over proof strength, is within a few tenths of the quantity of crystallised sugar known to be present. The large excess in No. 3 is doubtless due to the very limited solubility of inverted and uncrystallised sugars in alcohol of that strength, and the consequent difficulty of dissolving the whole of these sugars in a given number of washings, and thus liberating the crystallised portion. In No. 1 there is a considerable deficiency, which is probably due to the water in the sample having increased the solvent power of the alcohol at that strength in a greater ratio than in the other cases at the higher strengths. The additional quantity of crystallised sugar, however, which the reduced test liquor dissolves, is not, as a rule, in proportion to the reduction which the quantity of moisture in the sugar would make in the strength of the alcohol, a circumstance which is due to the fact that the time the test liquor and the sugar are in contact is too short to allow the former to become completely saturated.

After making a variety of experiments, it soon became obvious that the most suitable strength of alcohol to be used for preparing the test liquor lay between 50 and 56 over proof; but that it could not be absolutely affirmed that alcohol of any particular strength was applicable to the analysis of all descriptions of sugar, ranging from the finer qualities down to molasses.

To ascertain the relative value of alcohol at the strengths of 56 and 50 over proof for preparing the test liquor, a mixture was made, consisting of 60 parts of purified white sugar and 40 parts of treacle; and experiments were made on the mixture with saturated alcohol at each of the strengths named, with the following results:—

	Percentage of crystallised sugar.
Alcohol of 56 over proof gave	59·12
„ „ 50 „ „	57·72

Thus, with alcohol of a strength of 56 over proof, there was a loss of 0·88 of crystallised sugar; but, with the alcohol of 50 over proof, the loss amounted to 2·28 grains, or nearly 2½ per cent more than in the case of the alcohol of the higher strength.

The test in this case was very rigid, and, upon this ground, as well as from a slight loss which must inevitably occur in manipulation, the loss of the 0·88 of crystallised sugar with the alcohol of 56 over proof strength may be accounted for. With refined sugar, it is not only difficult to obtain an intimate and uniform mixture of the crushed crystals and treacle, but the crystals remain exposed, as it were, to the immediate action of the first portion of the test liquor, which acquires increased solvent power from the additional moisture which it takes up from the sugar.

The sample of treacle employed in the preparation of the mixture was found to contain 3·35 per cent of salts and other impurities insoluble in the test liquors; and, in calculating the results, an allowance was made for the proportion of insoluble matter contained in the quantity of treacle used in the experiments.

To determine whether a test liquor prepared from alcohol of a strength of 56 over proof would give uniform results with mixtures of crystallised and inverted sugars in all proportions, mixtures were made of treacle and raw sugar, varying from 10 to 90 per cent of each; and the several mixtures were submitted to careful analysis, and the same conditions observed in every instance. Three analyses were made of each mixture, and also of the raw sugar, and a mean of the results taken.

The raw sugar used was of medium quality, and gave 84·69 per cent of crystallised sugar. The treacle employed was the same as that used in the experiments referred to above; and, in each instance, the proper allowance was made for the proportion of salts and other impurities insoluble in the test liquor.

The mean results of the analyses made of the respective mixtures were as follows:—

				Percentage of crystallised sugar by calculation.	Percentage of crystallised sugar by experiment.	
90 parts of sugar and 10 of treacle				76·22	75·80	Loss. 0·42
80	,,	,, 20	,,	67·75	67·84	Gain. 0·09
70	,,	,, 30	,,	59·21	59·71	0·43
60	,,	,, 40	,,	50·81	51·44	0·63
50	,,	,, 50	,,	42·34	43·65	1·31
40	,,	,, 60	,,	33·87	36·01	2·14
30	,,	,, 70	,,	25·40	28·01	2·61

From the results of the experiments, it will be seen that, as the percentage of treacle is increased (the percentage of moisture being also thereby proportionately increased), the residue, contrary to what might have been expected, indicates a small but gradually-increasing excess over the percentage of crystallised sugar known to be present. This cannot be due to the salts and other impurities in the treacle which are insoluble in the test liquor, for they, as before stated, have already been allowed for. It is highly probable that it is caused by the increasing viscidity of the mixtures and the consequent difficulty of the alcohol, limited in quantity, and approaching nearer and nearer to its saturating point for inverted and uncrystallised sugars, in effecting the liberation of the crystallised portion.

The results obtained in the analysis of the mixtures containing 80 and 90 per cent of treacle respectively were considerably in excess of the quantity of crystallised sugar present; and it was obvious that the test liquor was inapplicable to the analysis of mixtures containing so large proportions of treacle.

The results accord very well with the theoretical percentages of crystallised sugar in the mixtures down to 50 per cent, but, from this point, the results are not so satisfactory as could be wished.

In the analysis of samples of sugar or mixtures of sugar and treacle in which the proportion of inverted and uncrystallised sugars amounts to upwards of 50 per cent, a test liquor prepared with alcohol of a slightly lower strength than 56 over proof is more suitable, and gives more accurate results; in fact, by gradually reducing the strength of the alcohol, and employing a fresh test liquor as the scale is descended, practically accurate results may be obtained down to the lowest mixture, consisting of 90 parts of treacle to 10 of sugar.

The mode in which the analyses were conducted may be shortly described. To alcohol of the proper strength, excess of finely-powdered purified white sugar was added, and the mixture was agitated for two or three days, and, as required for use, the clear saturated liquid was drawn off. 100 grains of the sample were then gently rubbed in a mortar with 200 fluid grains of the saturated alcohol, and the washings thrown upon a filter previously counterpoised with another filter. The operation of washing was repeated nine times, with the like quantity of fluid grains, the sugar in the mortar being gradually transferred to the filter, so that, when the 2000 grains of the test liquor were used, the whole of the sugar had been transferred to the filter. The counterpoised filter and that containing the crystallised sugar were then dried in a water-bath, and the difference in the weights, after allowing for the salts, &c., present in the treacle, and insoluble in the test-liquor, gave the percentage of crystallised sugar in the sample.

My best thanks are due to Messrs. Helm and Stokes for the valuable assistance which they rendered me in making the experiments connected with this investigation.

Permanent White, which is necessary in the manufacture of ultramarine, may be formed by adding to the washing waters of that dye sufficient chloride of barium to render the liquid no longer turbid. The precipitate, which is heavy, and falls quickly, may be deprived of a bluish tint by depositing a portion first, with which the ultramarine held in suspension also settles.

ON THE ACETIC DERIVATIVES OF HYDROCARBONACEOUS SUBSTANCES.

By MM. SCHUTZENBERGER and NAUDIN.

ACETIC anhydride reacts easily upon many immediate organic principles, playing the part of polyatomic alcohols. The total transformation of bodies into acetic derivatives is thus quickly effected, the degree of substitution varying according to the temperature and the quantity of the anhydride. Here are the results of my experiments.

Acetic Celluloses.—The cellulose (Swedish paper or cotton) was heated to 180° in a closed vessel with six or eight times its weight of acetic anhydride. It dissolved into a thick syrup, which, when poured into water, precipitated white flakes of triacetic cellulose—

$$C_6H_7(C_2H_3O)_3O_5,$$

insoluble in water, alcohol, or ether; soluble in concentrated acetic acid; easily saponifiable by alkalies, with regeneration of cellulose. Whatever the duration of the heating process or the excess of anhydride employed, no higher limit was reached. Cellulose is, then, a triatomic alcohol—

$$\left.\begin{matrix} C_6H_7O_2 \\ H_3 \end{matrix}\right\} O_3$$

On employing but two parts of anhydride, and heating to only 150°, the cotton swelled without dissolving, by reason of the simultaneous production of diacetic and monoacetic ethers, which could not be separated.

Starch and Dextrine.—Starch, when heated to 140° with excess of acetic anhydride, swelled greatly without dissolving. The mass, when washed with water, yielded a white, amorphous substance, insoluble in water, alcohol, ether, and acetic acid; not turned blue by iodine, and saponifiable by caustic alkalies, with regeneration of starch, turning blue by iodine. It represents triacetic starch $C_6H_7(C_2H_3O)_3O_5$. If the mixture of starch and acetic acid be heated to 160°, the swelled mass will dissolve, yielding an amber syrup. This, when poured into water, precipitates a white, amorphous matter, insoluble in water, alcohol, and ether, but soluble in glacial acetic acid. It is easily saponified by alkalies, with separation of dextrine. Its composition is the same as the preceding, and represents triacetic dextrine obtained directly by the action of the anhydride upon dextrine. The degree of substitution of the third order cannot be passed; those inferior were not examined, on account of the difficulty of distinguishing them. Starch and dextrine act, therefore, as triatomic alcohols.

Glycogene.—Glycogene, when heated at 155° with excess of acetic acid, swells without dissolving. The mass, washed in water, gives an amorphous, white product, insoluble in water (even warm), and in alcohol, ether, and acetic acid. It is saponified by alkalies, with regeneration of glycogene. It represents the maximum of saturation, and is triatomic—$C_6H_7(C_2H_3O)_3O_5$.

Gum Arabic.—This substance, when heated with about two parts of acetic anhydride to 150° for some hours, swells without dissolving. The mass, washed first with boiling water and then with alcohol, leaves an amorphous white powder, insoluble in boiling water, and saponified by alkalies, with regeneration of soluble arabin. It represents diacetic arabin, $C_6H_8(C_2H_3O)_2O_5$. By employing an excess of 6 to 8 parts of acetic anhydride, and heating to 180° for five or six hours, a triacetic derivative is obtained, similar in its properties to the preceding one: this is the highest degree of substitution.

Inuline.—This yields, under the same conditions, a saturated, triacetic derivative, soluble in water, of a bitter taste, and melting, at about 110°, into a syrup which solidifies into a vitreous, transparent, and colourless mass. It is easily saponified by alkalies, with regeneration of a white body, insoluble in water, and which melts below

100°. Thus, cellulose and its isomers of the formula $C_6H_{10}O_5$ all give saturated derivatives of the third degree, easily distinguishable from each other by their character of solubility and the nature of the products generated by saponification.

Acetic Derivatives of Sugar.—The action of acetic anhydride on sugar is vigorous: the reaction begins at the instant when the acid boils, and ends of its own accord in a few moments, with great development of heat. The sugar was heated for twenty-four hours at 170° with large excess of anhydride. Alkalies could not here be used for decomposition on account of their ulterior action upon sugar, but it was easily effected by water only at 160°.

Acetic Glucose.—One part of dry glucose, heated to the boiling point of the acetic anhydride with 2¼ parts of the latter, in an open vessel, gives a lively reaction, ending in a few moments. The product, when suitably purified, is solid, colourless, and of a bitter taste. It is soluble in water, alcohol, ether, and acetic acid, and melts below 100°. Its analysis corresponds with the formula for diacetic glucose, $C_6H_{10}(C_2H_3O)_2O_6$. This substance, when again heated to 140° with about twice its weight of anhydride, yields a second solid derivative, distinguished from the first by its slight solubility in pure water. It dissolves in water containing acetic acid, in alcohol, and ether, and represents triacetic glucose. This latter, maintained at 160° for twenty-four hours with a large excess of anhydride, changes into a saturated product very similar to the preceding, but differing by its insolubility in water charged with acetic acid. The acetic liquid, poured into water, yields a viscous precipitate, which is washed with water, again dissolved in alcohol containing bone-black, filtered, and evaporated to dryness. Its composition, which is ascertained by combustion and estimation of the acetyle, is that of tetracetic glucose, wanting a demi-molecule of water, and answers to the formula $C_{12}H_{14}(C_2H_3O)_8O_{11}$. The more simple formula, $C_6H_6(C_2H_3O)_4O_5$, may, perhaps, be employed, but it does not tally so well with the results of the analysis. Under these conditions, glucose undergoes a partial dehydratation. Cane-sugar yields, under similar circumstances, a saturated derivative, undistinguished in character or composition from the preceding. (The rotatory power was not studied).

Lactine, heated to 140° with acetic acid, dissolves entirely. The liquid, when poured into water, yields a viscous precipitate, which quickly becomes powdery. Acetic lactine softens at about 52°; its composition corresponds with the formula $C_{12}H_{14}(C_2H_3O)_8O_{11}$, or $C_6H_6(C_2H_3O)_4O_5$.—*Comptes Rendus.*

ON THE

OXIDATION OF PHOSPHORUS

AND THE

QUANTITY OF PHOSPHORIC ACID EXCRETED BY THE KIDNEYS IN CONNECTION WITH ATMOSPHERIC CONDITIONS.*

By J. MOFFAT, M.D., F.R.A.S., F.G.S.

From results deduced from observations on the luminosity of phosphorus in connection with atmospheric conditions for a period of six years, it appears that periods of phosphorescence and ozone periods commence, continue, and terminate under the same atmospheric conditions; that phosphoric ozone is formed only when phosphorus is luminous, and that increase of temperature and low atmospheric pressure are favourable to luminosity, while low temperature and high atmospheric pressure are unfavourable to it.

While the readings of the barometer are increasing and the wind is veering towards the N. points of the compass, phosphorescence diminishes in brilliancy and ozone in quantity; and, while the polar current continues, the barometer attains its maximum, the wind veers from N. to E., phosphorus becomes non-luminous, and ozone disappears. If, when the wind has veered to the E., the barometer readings begin to decrease, the wind sets in from points by S., phosphorus becomes luminous, and ozone appears; and, while the south or equatorial current continues, the barometer readings fall to a minimum, the wind veers from S. to W. points, phosphorescence becomes brilliant, and ozone is in maximum quantity. Liquid and gaseous bodies, when in contact with phosphorus in a non-luminous state, become phosphorated, and they, under suitable conditions, become phosphorescent and ozonised, the temperature at which phosphorescence takes place varying with the pressure of the atmosphere.

As venous blood contains phosphorus (phosphorated fat), which, in coming in contact with the oxygen of the air during respiration, is converted into phosphoric acid (the blood, perhaps, being ozonised at the same time), and combines with the alkalies and earths in the *liquor sanguinis*, and forms phosphates of soda, magnesia, and lime, it appeared to me not unreasonable to suppose that the quantity of phosphorus oxidated and phosphates formed in the system, and eliminated from it through the kidneys, is in some degree determined by the pressure and temperature of the atmosphere, and the state of the weather generally.

With a view to ascertain the quantity of phosphoric acid excreted by the kidneys, I tested the urine of a healthy man daily for twelve months. The quantity of urine evacuated in twenty-four hours was measured daily, and the quantity of phosphoric acid in one ounce of it ascertained. The man was of abstemious habits; his food seldom varied in kind or quantity. It consisted of tea, bread-and-butter, eggs, animal food, rice, oatmeal, and milk. The two articles in excess were bread and milk; of the latter he took at least 3 pints daily. The readings of the barometer and thermometer, the quantity of atmospheric ozone, and the direction of the wind, were recorded daily. The results were deduced monthly, and tabulated as below.

Table I.

Showing the Mean Daily Quantity of Phosphoric Acid Excreted by the Kidneys when—

The barometer was				Temperature was		Ozone was		Phosphorus was		The wind was			
Increasing.	Decreasing.	Above 30 in.	Above 29 in., below 30 in.	Above 28 in., below 29 in.	Increasing.	Decreasing.	Present.	Absent.	Luminous.	Non-luminous.	N. to E.	E. to S.	S. to W.	W. to N.
grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
58·8	62·8	53·6	57·5	67·5	62·4	61·4	62·0	56·0	60·0	57·0	56·8	59·5	62·0	61·4

From these results, then, it would appear that the maximum quantity of phosphoric acid excreted from, and in all probability formed in, the system occurs with the conditions of the equatorial or south and ozoniferous current of the atmosphere, and that the minimum quantity occurs with the conditions of the polar or north and non-ozoniferous current. The results of the observations for each month were similar to those in the table, with the exception of March and May. In March, there were 2 grains more of daily mean with increasing than with decreasing readings of the barometer; and, in May, the quantities were equal for both sets of readings. The range of the barometer, for March and May, was 1·247 in. only; while, for August and November, the range was 1·532 in.; and the difference in the quantities of phosphoric acid excreted was a daily mean of 12 grains more with decreasing than increasing readings. When the

* Read before the British Association, Exeter meeting, Section B.

range of the barometer for the month is above 1·5 in., the difference in the two sets of readings is 6·8 grains more with decreasing than increasing readings; and, when the range is less than 1·5 in., the mean difference between the two sets of readings is 3·4 grains more only for decreasing than increasing readings.

During the months from October to February (both inclusive), that is, during the months in which the temperature of the air is owing more to atmospheric than solar influence, a piece of phosphorus was kept in a dark cellar. It was examined daily, and the quantity consumed or oxidised was ascertained monthly. The results are given in the following table:—

TABLE II.

Showing that, when the Mean Monthly Reading of the Barometer was—

Between	The quantity of phosphorus oxidised was	The mean daily quantity of ozone was	The No. of ozone days was	The mean daily quantity of phosphoric acid excreted was
in.	grs.			grs.
29·0 and 29·5	41·3	2	18	62·5
29·5 ,, 30·0	20·0	1	8	55·6

From this, it would appear that the amount of phosphorus oxidised in the air and the amount oxidised within us depends upon similar atmospheric conditions. The readings of the barometer which lead to the issuing of cautionary (Admiral Fitzroy's) telegrams are, of course, decreasing.

I have observed that 94 per cent of the telegrams are accompanied by the commencement of periods of phosphorescence. Atmospheric ozone invariably appears or increases in quantity with them. The mean daily quantity of phosphoric acid excreted by the kidneys on the day before the telegrams is 65·3 grains; and, on the day of it, 63·9 grains; giving a mean of 64·6 grains, which is 3½ grains daily above the mean.

The diseases which accompany the meteorological changes which appear to lead to the foregoing results I leave for future discussion.

Hawarden, July, 1869.

NOTICES OF BOOKS.

Field's Chromatography, or Treatise on Colours and Pigments as used by Artists. A new edition, re-written by THOMAS W. SALTER, F.C.S. London: Winsor and Newton, 38, Rathbone Place. Pp. 435; 8vo.

WE have, unfortunately, too many examples of the disastrous effects which ensue from the use of certain colours by artists who are unaware of their nature and durability. Many a grand and immortal work of art has suffered irretrievably from the fading of some paints, and the blackening of others, and the effects of damp and impure air upon others. Sometimes colours slowly react upon each other: sometimes bright lead colours pass, in the course of years, into the dingiest of greys, ultimately becoming almost metallically black from the sulphur of the air by which they are surrounded. Now, with all this in view, the appointment of a Lecturer on chemistry to the Royal Academy of Arts has been more than once seriously discussed, and we may hope that, sooner or later, will be carried into effect. In the same direction, and tending to remove such like conflictions of chemical with artistic lore, is Field's "Chromatography;" and we are happy to welcome a new and revised edition of it. Fortunately, its reviser, Mr. Salter, is a chemist; so that artists have already within their grasp a certain application of chemical knowledge to the usages of their craft.

In the preface to this new edition, Mr. Salter informs us that the work has been entirely revised and re-written, "the notices of colours have been considerably extended, their chemical and artistic properties more fully dilated on, and many new pigments of the utmost importance described." Mr. William Winsor was engaged upon the revision of this work at the time of his death, and his *collaborateur* regrets that the intimate knowledge of colours which Mr. Winsor possessed can no longer be applied to the purposes of the revision.

The "Chromatography" is divided into three parts—Part I. "On Colours and Colouring;" Part II. "On Colours and Pigments generally;" Part III. "On Colours and Pigments individually."

In the first chapter, an infinitely too brief history of the prominent phases in painting is given, and allusion is made to the early works of the Egyptians and Greeks. There are, it is asserted, in reality, but three schools of painting—the *Material*, the *Sensible*, and the *Intellectual*. "Modern art, as founded upon the *intellectual* school of the ancient Greeks, became grand, scientific, and severe in the practice of Michael Angelo and Leonardo de Vinci; graceful, beautiful, and expressive in Raphael, Correggio, Dominichino, and Guido; and, aiming at *sensible* perfection, it attained harmony of colouring and effect in the works of Titian and Tintoret; but it sunk into grossness and sensuality while perfecting itself *materially* among the Flemish and Dutch." This is indeed a sweeping survey, so sweeping that no mention is made of the French or Spanish schools. We would not ask it for ourselves, for it is so recently that anything like an English school of painting—and that a mongrel and a bastard offspring—has arisen, that we can well make no demands for recognition; but surely, in the above statement, the name of Fra Angelico de Fiesole should come in between Raphael and Correggio; nay, we know not whether he should not be placed at the head of those painters who brought art to its culminating point in regard to the graceful, the beautiful, and the divine. What shall we say to those glorious angels, with wings sprinkled with golden stars, who are ascending jubilantly upon the purple clouds which curl at their feet? Or what shall we say to the serene and infinitely majestic and calm S. John, seated upon the outspread wings of an eagle? The art of to-day is as far behind the art of that day as the science of to-day is in advance of the science of that day. We always think that picture must have reference to Fra Angelico in which we see a monk who, seated in front of his painting, has fallen asleep over his work, while an angel, taking the brush from his fingers, continues that which he has left undone.

Passing on now to the third chapter, which commences Part II., we find some very useful definitions; for example, "By mixing his colours with white, the artist obtains his *tints*. By mixing colours with colours, he produces compound colours, or hues; and, by mixing colours or tints with black, he gets *shades*." Colours themselves are divided into five classes; the Neutral, the Primary, the Secondary, the Tertiary, and the Semi-Neutral. Neutral colours are *black*, *white*, and *grey*. Primary colours are *yellow*, *red*, and *blue*. Secondary colours are *orange*, *green*, and *purple*. Tertiary colours are *citrine*, *russet*, and *olive*. Semi-neutral colours comprehend all the combinations of primary, secondary, and tertiary colours, with the neutral black.

In regard to the "durability and evanescence of pigments," we have a good deal of useful information in chapter 4. The organic colours are most easily affected by light and air; compounds of lead, mercury, and copper by air containing sulphuretted hydrogen. Many colours are altered by the action of lead pigments, and others, again, by ferruginous pigments; finally, the vehicles and varnishes with which colours are mixed often act deleteriously upon the colours.

No less than seven-eighths of the work are devoted to colours and pigments individually considered; and we have here a long list of colours, with an account of their composition and general qualities: let us take the fo

lowing as an example of the mode of description here employed:—"Burnt carmine is the carmine of cochineal partially charred, until it resembles, in colour, the purple of gold, for which, in miniature and water-painting, it is substituted. It is a magnificent reddish purple, of extreme richness and depth, eligible in flower painting and the shadows of drapery. As it is generally impossible, however, to alter the nature of a pigment by merely changing its colour, burnt carmine is scarcely more permanent than the carmine from which it is produced. If used, therefore, it should be in a body, and not in thin washes, or as a glaze. Durable pigments are admissible in any form; but semi-stable pigments (gamboge excepted) should only be employed in body."

We are glad to notice that descriptions of new pigments have been introduced; thus we have aureolin, thallium red, tungstate of baryta, viridian, brun de mars, indium yellow, and molybdenum green.

The "Chromatography" cannot but prove most valuable to all who are interested in art; and we cordially recommend it even to that dignified and austere Body which dictates the art taste of the kingdom.

The Chemical Manufacturer's Plant, as Supplied by the St. Helen's Foundry, Lancashire."

THIS is an illustrated catalogue of various vessels employed in some of the chemical manufactures, notably in the two greater industries, sulphuric acid and soda. Thus we have pyrites' burner frames, nitre pots, decomposing pans, black ash vats, crystallising pans, &c. Some of the decomposing pans described have a thickness of no less than 7 inches at the bottom; the charge of salt is from 5 to 18 cwts.; and the amount of salt-cake decomposed in a pot varies from 1000 to 2700 tons. The "black ash revolving furnace" is also figured, and appears to be replacing the old hand-furnace in Lancashire and elsewhere.

CORRESPONDENCE.

INK.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xx., p. 155) you give M. Voigt's recipe for "a very black and very cheap ink." The objections to it seem to me to be these—(1) It involves a number of unnecessarily troublesome processes; (2) it requires the use of sulphate of copper, which leads to the deposit of copper on steel pens, and so makes them useless; (3) it prescribes corrosive sublimate, which is not good for little boys, who will suck their pens; (4) it recommends logwood, which gives a brownish tone to ink.

For any one who wishes to make his own writing-ink, I do not know an easier or better method than that adopted by the late Professor Daniell, of King's College. He put into a stone-ware jar 1 gallon of soft water, ¾ lb. of bruised nut-galls, and next day 6 ozs. of green vitriol, 6 ozs. of gum arabic, and 4 or 5 drops of kreosote. The bottle was then corked, and left in a corner of the room for two or three weeks, so that, once in two days, or so, it might remind the owner that it wanted a good shaking. After this, it was left a few days, and then the clear liquor was decanted off for use. This formed a very black, a very cheap, and, what is more, a very durable ink.

I have letters from Professor Daniell written with such ink a quarter of a century ago, and from Snow Harris (who used the same ink), of the same date, and they form a good written character of this useful black servant.—I am, &c., C. T.

September 25th, 1869.

MISCELLANEOUS.

Discovery of Bismuth Ore.—On an estate belonging to M. Carnac, near Balhannah, South Australia, a very valuable lode of bismuth has been found, while some miners were seeking for copper ore. Since bismuth has very much increased in price, and is increasingly in demand, this discovery is a highly welcome one.

Incrustations in Boilers may be prevented by introducing raw potatoes, which cause all solid matters to be precipitated at the bottom of the boiler in a fine powder, leaving the sides perfectly free. The experiment was tried with an engine of 8-horse power, into the boiler of which ten kilogrammes of potatoes per week were introduced through the safety-valve. Every week, when the fires were extinguished, the deposit was removed previous to the introduction of a fresh supply of potatoes. On examining the boiler after fourteen consecutive months of work, no traces of incrustation were perceptible; the appearance of the plates was blackish and slightly greasy, and the corners of the joints were in the same state as when first made. Refuse leather-cuttings from the tanneries will answer the purpose equally well.—*Annales de Génie Civil.*

Electro-Plating of Paper or other Fibrous Material.—The *Druggist's Circular* says—"A mode has been devised for depositing copper, silver, or gold, by the electric process, upon paper, or any other fibrous material. This is accomplished by first rendering the paper a good conductor of electricity without coating it with any material which will peel off. One of the best methods is to take a solution of nitrate of silver, pour in liquid ammonia till the precipitate formed at first is entirely dissolved again; then place the paper, silk, or muslin for one or two hours in this solution. After taking it out and drying well, it is exposed to a current of hydrogen gas, by which operation the silver is reduced to a metallic state, and the material becomes so good a conductor of electricity that it may be electro-plated with copper, silver, or gold, in the usual manner. Material prepared in this manner may be employed for various useful and ornamental purposes.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, September 13, 1869.

This number, an unusually small one, contains, among its most remarkable communications, the startling intelligence that the manuscripts and signatures, about which M. Chasles has made so much fuss, are nothing but the work of a clever forger, who, by dint of study and perseverance, has been enabled to carry on a very successful, but, happily, now interrupted, business. M. Dumas read a small portion of a lengthy memoir on the—

Spectrum of the Solar Spots, as observed by the Rev. Father Secchi, S.J.—This paper, and the following, on the—

Constitution of the Luminous Spectra (M. Lecoq de Boisbaudran) are too lengthy, on the one hand, and too concisely written, on the other, to admit of any useful abstraction.

Researches on the Nature of the Products of Fermentation of Glycerine produced by Microzymas.—M. Béchamp.—The author briefly reviews the labours of M. Redtenbacher on this subject, stating that that chemist had transformed glycerine, after addition of beer yeast, into propionic acid. The author of this paper has applied to his researches a mixture consisting of pure glycerine, 250 grms.; chalk, from Sens, full of well and lively-moving microzymas; hashed mutton, quite fresh, and previously washed with cold water, 30 grms.; cold water, 3000 c.c. This mixture has been kept at a temperature of from 35° to 40° for several months. The chief results obtained by the author are, that propionic, butyric, caproic, and valeric acids are formed most abundantly; among the gaseous products, carbonic acid, hydrogen, and nitrogen are found as result of this fermentation.

September 20, 1869.

This number contains the following original papers relating to chemistry or sciences allied thereto:—

Preparation of Nitrogen.—Mr. Calvert.—The author suggests that a mixture of hypochlorite of lime and sulphate of ammonia be made in the following manner:—200 c.c. of an aqueous solution of hypochlorite of lime, containing 5·14 of hypochlorous acid, to which is added 1·146 of sulphate of ammonia, previously dried at 220°; nitrogen gas is immediately given off, even without the application of heat, but it is better to apply heat very gently. The author observes, further, that all nitrogenised animal matters (such as albumen, fibrin, gelatine, silk, feathers, and skin) yield, when mixed with a solution of hypochlorite of lime, especially when heat is applied, a large quantity of nitrogen and carbonic acid. Ulterior researches on this subject are promised.

Researches on the Microzymas of the Blood and on the Nature of Fibrin.—MM. Béchamp and Ester.—This is, strictly speaking, a physiological paper. It is somewhat curious to learn that the coagulation of blood should be due to the juxtaposition and agglutination of minute globules (not the blood corpuscles) and that these globules should be microzymas, and capable of effecting the saccharification of the starch.

Heat Emitted from the Moon.—M. Marié-Davy.—According to the very accurate researches and experimental observations of this author, the heating power of the rays of the moon is incapable of raising the one-millionth part of a degree the temperature of a very sensitive air-thermometer covered with lampblack. This result disagrees with the results obtained by Lord Rosse, when he made observations on this subject.

New Kind of Gunpowder.—M. Brugère.—The author mixes 54 parts of picrate of ammonia and 46 parts of nitrate of potassa; on burning off, this mixture only, leaves carbonate of potassa. The following formula explains the reaction:—

$$C_{12}H_2(NO_4)_2NH_4O_2 + 2(KO,NO_5) = 10CO_2 + 6N + 6H + 2(KO,CO_2).$$

The author states that this powder presents the following advantages over ordinary powder:—It is more homogeneous, and its effects are consequently more regular; it is far less hygroscopic; it is more effective for equal weights; and it leaves far less solid matter on combustion. The residue left after combustion does not affect metals, since it is only carbonate of potassa; this powder hardly emits any smoke at all, and what little is emitted is devoid of smell. The author recommends a mixture of 25 grms. of picrate of ammonia, 67 grms. of nitrate of baryta, and 8 grms. of sulphur, as an excellent substitute for Bengal light, and as suitable for signal and port lights, and use in theatres, since hardly any smoke is emitted and no unpleasant smell given off, while the light is very brilliant, slow burning, and yields a beautiful greenish tinge.

Annalen der Chemie und Pharmacie, July, 1869.

This number contains the following original papers:—

New Mode of the Formation of Nitro-Prussides.—M. Städeler.—The author begins this monograph by a lengthy description of the manner in which he ascertained the composition of the orange-coloured precipitate which ensues when a solution of cyanide of potassium is added to a solution of a proto-salt of iron. The quantitative estimation of the proportions of the proto-salt of iron and of the cyanide of potassium were found to be in relation as 3 : 4, or 4 : 5; the formula for the orange-coloured precipitate alluded to is, accordingly, Fe_3Cy_8K. In order to test the accuracy of this formula, the author tried to convert the orange-coloured precipitate into a nitro-prusside, according to this schematic formula—

$$Fe_3Cy_8K + NO.OK = FeO + Fe(NO)Cy_5K_2.$$

The result of experiment confirmed the correctness of the author's opinion; but the reaction was not found to take place so simply, for, instead of the formation of protoxide of iron and nitro-prusside of potassium, there is formed magnetic oxide of iron and the nitro-prusside; the formation of the nitro-prussides without acids is, therefore, the author's discovery. The orange-coloured precipitate above alluded to is converted into nitro-prusside by being treated with nitrite of potassium, best, after that orange-coloured body has become oxidised, by exposure to air. A portion of this paper is devoted to the discussion of the correctness of the formula generally adopted for nitro-prussides, and due to Gerhardt's researches on this subject.

On Anisaldehyde.—Dr. Rossel.—The author first reviews the labours of MM. Cahours, Piria, Canizzarro, Bertagnini, and others, on this subject. The author states that the anisaldehyde is best prepared by mixing 1 part of essential oil of anise, 2 parts of bichromate of potassa, 3 parts of concentrated sulphuric acid, and 8½ parts of water. When 100 grms. of the essential oil are operated upon, about 50 per cent of aldehyde is obtained. The raw product, after having been purified, exhibits a nearly colourless fluid, of 1·1228 sp. gr. at 18°; it is readily soluble in alcohol and ether, but not so in water; its reaction is neutral, but, since it oxidises very readily to anisic acid, a few drops of the aldehyde, on exposure to air, become solid, and, at the same time, exhibit acid reaction to test-paper. This aldehyde is composed of $C_8H_8O_2$. The author has succeeded in obtaining several derivatives from this anisaldehyde, among which are anisoine, $C_{16}H_{16}O_4$, a solid substance crystallising in six-sided prisms, hydranisoine, isohydranisoine, desoxyanisoine, and anishumine.

On Diphenyl.—M. Brönner.—While engaged in rectifying a large quantity of benzol, made by the distillation of a mixture of benzoate of lime and slaked lime, there remained in the retort a solid crystalline substance, which was found to be insoluble in water, and readily soluble in ether and in boiling alcohol, from which latter solution it was obtained in a pearly, crystalline mass, fusing at 70·5°, and which, on being submitted to elementary organic analysis, yielded results leading to the formula, $C_{12}H_{10}$—that is to say, the same as the substance M. Fittig obtained by acting with sodium upon monobrombenzol. The reactions of the latter substance, as described by Fittig, and tried by the author of this paper, with the substance obtained by him in the manner above described, agree in all respects; and there is no doubt, therefore, that both materials are identical, and deserve to bear the same name.

Relations existing between Amylen and Oil of Turpentine.—Drs. Bauer and Verson.—The chief leading points of this memoir may be summarised thus:—1st. Two molecules of amylen form one molecule of diamylen—

$$C_5H_{10} + C_5H_{10} = C_{10}H_{20}.$$

2nd. Diamylen and bromine form diamylen-bromide; and this last named substance forms rutylen, when it is treated with an alcoholic solution of caustic potassa—

$$C_{10}H_{20}Br + 2KHO = 2KBr + 2H_2O + C_{10}H_{18}.$$

3rd. Rutylen forms, with bromine, a bromide of rutylen, and this, on being treated with an alcoholic solution of caustic potassa, yields the new hydrocarbon—

$$C_{10}H_{18}Br + 2KHO = 2KBr + 2H_2O + C_{10}H_{16}.$$

$C_{10}H_{16}$ is evidently related to terebene, which, as observed by M. Berthelot, is the "terme commun et stable auquel tous les carbures, $C_{10}H_{10}$, viennent aboutir."

Products of the Action of Chlorous Acid upon Naphthaline.—M. Hermann.—The products obtained by this reaction are—An acid containing chlorine, phthalic acid, the acid potassa salt of a new sulpho-acid, and bichloride of naphthalin. The author describes these products, and many of their combinations, at great length. The formula of the chlorine containing acid is $C_{10}H_7ClO_6$; this acid readily forms salts, most of which crystallise. The bichloride of naphthaline, $C_{10}H_8Cl_2$, is a solid crystalline substance, fusing at 68°, and soluble in alcohol. The new sulpho-acid above named is *Naphthochinonsulpho acid*, the potassa salt of which contains, in 100 parts:—Carbon, 36·73; hydrogen, 1·22; potassium, 12·00; chlorine, 10·87; sulphur, 9·79; oxygen, 29·39. Formula, $C_{10}H_4KClSO_6$.

Specific Heat of Saturated Vapours.—M. J. A. Groshans.—This paper, a very learned essay on this subject, being entirely based upon higher algebra, is not well suited for abstraction.

Some Derivatives from Creosol.—M. Biechele.—The author first reviews the labours of Hlasiwetz, Hugo Müller, Gorup-Besanez, Sobrero, and others, on this subject; and then he describes a series of his own experiments, treating first on creosol-potassium—

$$C_8H_9KO_2 + 2H_2O.$$

Creosol, obtained by decomposing the salt just named by means of sulphuric acid. The substance thus obtained is, after purifying, a colourless, oily liquid, highly refractive, boiling between 209° and 220°, becoming a solid mass when treated with ammonia, and reducing salts of silver to the metallic state; formula, $C_8H_{10}O_2$. Creosol-sulpho acid.—The result of the action of sulphuric acid upon rectified creosote is a liquid readily absorbing water from the atmosphere; its formula is $C_8H_9O_2.SO_3H$. This acid forms, with baryta, oxide of lead, and potassa, salts readily soluble in water. When chloride of phosphorus acts upon creosote, the chloride of creosol, C_8H_9OCl, is among the products.

Action of Hypochlorous Acid upon Butylen.—M. Lieben.—By this reaction, butylen-chlorhydrin, chlorinated dibutylen-chloride, are obtained; but the very concise description given by the author, of a long series of rather complicated chemical operations, cannot be readily condensed. The formula of chlorinated dibutylen-chloride is—

$$\left\{\begin{matrix} C_4H_8Cl \\ C_4H_7Cl.Cl \end{matrix}\right.$$

Since the oxidation of an alcohol obtained from butylen-chlorhydrin yields acetic acid, the author states as his opinion, based upon his researches, that the alcohol just alluded to is ethyl-methyl-carbinol.

The two remaining papers in this number are taken, one from the *Proceedings of the Royal Society*, the other from the *Comptes Rendus*, and have both been already abstracted in our pages.

August, 1869.

This number contains the following original papers:—

Amines of Xylyl-Alcohol.—Dr. O. Pieper.—Chlorine gas is first passed into boiling xylol, and the chloride so formed is treated at 116°, in sealed tubes, with a strong solution of ammoniacal gas in alcohol. The contents of the tube, after the reaction was finished, was treated with alcohol; and this fluid, along with excess of ammonia, was removed by distillation. The author thus obtained trixylylamine, $(C_8H_9)_3N$, a colourless, viscous, oily fluid, specifically lighter than water, not soluble in that fluid, difficultly soluble in alcohol, but readily soluble in ether. Hydrochlorate of trixylylamine, $(C_8H_9)_3N,HCl$, a solid substance, exhibiting perfectly snow-white needle-shaped crystals, not soluble in water and ether, difficultly soluble in cold, but readily in hot alcohol, and fusing at 212°. Bixylylamine, $(C_8H_9)_2HN$, a somewhat yellowish coloured oil, exhibiting an alkaline reaction to test paper, specifically lighter than water, insoluble therein, soluble in alcohol and ether, and decomposed if heated above 210°. Xylylamine, $(C_8H_9)H_2N$, also an oily liquid, boiling at 196°, soluble in alcohol and ether, and insoluble in water; it attracts carbonic acid from the air, and solidifies.

Decomposition of Tri- and Bi-Benzylamine by Heat.—Dr. L. Brunner.—The author divides his essay in two parts, treating in the first on the products of distillation of tri- and bi-benzylamine. Among the fluid products is toluol, boiling at 112°. Among the solid

products, dibenzyl, $C_{14}H_{14}$, obtained, after re-crystallisation, in large foliated shiny crystals fusing at 52°; toluylen, $C_{14}H_{12}$, a solid body, fusing at 120°. Among the residues of the distillation, left in the retort, and treated of in the second part of this essay, we notice lophin, $C_{21}H_{16}N_2$, a solid body, crystallising in needle-shaped crystals, fusing between 260° and 270°. When lophin is placed in a current of dry hydrochloric acid gas, and a dry current of carbonic acid gas passed over it, the compound $C_{21}H_{16}N_2 2HCl$ is formed.

Amines of Chlorinated Benzyl-Alcohol.—M. Berlin.—By a complicated process, described at too great length for any useful abstraction, the author has obtained a series of chlorinated compounds, and combinations of these with other substances. We notice among them—Chlorinated tri-benzylamine, $(C_7H_6Cl)_3N$, a solid substance, soluble in alcohol, and fusing at about 89°. Chlorinated bibenzylamine, $(C_7H_6Cl)_2HN$; the author discovered no less than four varieties of this base, designated, respectively, α, β, γ, and δ, and studied the salts they form. Chlorinated benzylamine, $(C_7H_6Cl)H_2N$, a colourless liquid, readily soluble in alcohol and ether, but not in water; it attracts carbonic acid from the air, and is thereby converted into a solid substance.

Variable Behaviour of Iodine towards Hydrosulphuric Acid under Divers Conditions, and the Causes thereof.—M. A. Naumann.—This essay treats on the part water (and what the author calls thermochemical action) plays in the reactions between iodine and sulphuretted hydrogen gas. Dry sulphuretted hydrogen and iodine, dissolved in anhydrous sulphide of carbon, do not act at all upon each other; neither does sulphuretted hydrogen act upon solid iodine, or vapours thereof if water is excluded. The greater portion of this essay is not well suited for abstraction.

Researches on Phloron and Cresol, and some of their Derivatives.—A. von Rad.—This is a lengthy monograph on the subject named; the mode of treatment and the concise manner in which it is written make it unsuitable for condensation.

Conversion of Urea into Carbaminic Acid.—M. H. Bunte.—About 8 grms. of nitrate of urea were mixed with absolute alcohol, and heated in a sealed tube, for some hours, at about 130°. The contents of the tube, which had nearly become solid, were dissolved in water, next treated with ether, and, after more purifying, a substance was obtained yielding, on elementary analysis, results leading to the formula $C_2H_7NO_2$. The remainder of this paper is devoted to a lengthy theoretical discussion on the various methods to ascertain the true nature of *substituted* ureas.

Condensed Ureas.—M. Schiff.—The author describes, at great length, a number of compounds which he calls *condensed ureas*, and which are made up according to the general formula—

$$XCH_4N_2O+(X-1)CnHmO-(X-1)H_2O.$$

Since this paper is, *de facto*, an exhaustive monograph on this subject, it is difficult to give any further abstract of the details it contains.

Compounds of Ammonia and Sulphate of Zinc.—M. G. Müller.—The author gives the following results of analysis of compounds of sulphate of zinc and ammonia, percentically:—Oxide of zinc, 30·58; sulphuric acid, 30·18; ammonia, 25·65; water, 13·59. Formula—

$$1ZnO1SO_34NH_32H_2O.$$

Oxide of zinc, 26·91; sulphuric acid, 26·58; ammonia, 22·59; water, 23·92. Formula—

$$1ZnO1SO_34NH_34H_2O, \text{ or } \left(\begin{matrix}SO_3\\Zn\end{matrix}\right\}O_2,4NH_3\Big),4H_2O.$$

Recovery of Nitrate of Uranium from the Phosphate of Uranium, and on a Nitro-Phosphate of Oxide of Uranium.—M. Heintz.—Since this paper bears upon a subject of importance to many chemists, and, since it is too lengthy for suitable abstraction, we intend to give it in full at a future period.

Chromate of Oxide of Zinc and Ammonia.—M. L. Bieler.—The author describes, at great length, the preparation of a salt composed, in 100 parts, of—Oxide of chromium, 33·01; oxide of zinc, 26·73; ammonia, 22·44; water, 17·82. This salt is readily soluble in dilute acids, crystallises, is decomposed by water, exhales ammonia constantly, and is, hence, readily and spontaneously decomposed.

Behaviour of Boracic Acid towards Oxide of Copper, Borate of Copper, and Ammonia.—M. Pasternack.—After reviewing the labours on this subject by MM. Tünnermann and Rose, the author records some experiments made by him in order to settle what compound is formed when a solution of two parts of sulphate of copper, and a solution of one part, by weight, of borax, are mixed, care being taken to pour the latter solution into the former. The mixture was next heated, filtered, and washed with warm water, whereby all the boracic acid was eliminated, and a salt left containing, in 100 parts—Sulphuric acid, 18·65; oxide of copper, 64·65; water, 16·79. To the filtrate obtained was added a fresh quantity of solution of borax, and a salt obtained containing, percentically—CuO, 52·72; B_2O_3, 18·59; H_4O, 28·69. A combination of boracic acid, ammonia, oxide of copper, and water, a true basic salt, had the following percentical composition:—CuO, 20·80; B_2O_3, 35·41; NH_3, 17·20; H_2O, 27·31.

Borate of Zinc and Ammonia.—M. Büscher.—This paper is analogous to the foregoing. The borate obtained consists, in 100 parts, of—ZnO, 20·40; B_2O_3, 35·27; NH_3, 17·13; water, 27·20.

Action of Acids upon Carbylamines.—This paper is not well suited for useful abstraction.

Synthesis of Paramonochlorobenzoic Acid.—M. C. Muller.—The acid just named is obtained in large quantity by the oxidation of chloride of benzol, after having been purified and dried over sulphuric acid. Paramonochlorobenzoic acid is a solid, fusing at 235°, readily soluble in alcohol and ether, but very difficultly soluble in water. Formula, $C_7H_5ClO_2$. Its baryta salt crystallises readily.

New Mode of Formation of Ethylsulphuric Acid.—M. Heusser.—By means of the action of sesquichloride of sulphur upon alcohol, and simultaneous exclusion of oxygen, the author has succeeded, by a method described at great length, in obtaining a baryta compound, $(C_2H_5)Ba''S_2O_6(OH_2)_2$, which is ethyl-sulphate of barium. The paper discusses, at great length, the labours of MM. Carius, Warlitz, and others on this subject.

Nitride of Boron.—M. Darmstadt.—The author finds that this compound of boron and nitrogen can be readily obtained when one part of previously fused and powdered boracic acid, and about two parts of urea, are mixed and heated in a covered porcelain crucible, first more gently, at last to red heat. The fused mass is lixiviated with hot water acidified with a few drops of hydrochloric acid, in order to promote the deposition of the nitride of boron.

Journal de Pharmacie et de Chimie, August, 1869.

This number contains the following original papers:—

Magnetic Oxide of Iron and its Salts.—M. Lefort.—After briefly referring to the labours of M. Fourcroy, and other chemists of comparatively older date, the author describes, at some length, the preparation of the ferroso-ferric oxide of iron in the following manner:—100 grms. of pure sulphate of protoxide of iron is dissolved in a small quantity of distilled water previously freed, by long-continued boiling, from all air; 200 grms. of the same salt are placed in a suitable vessel, containing already 50 grms. of nitric acid and 50 grms. of water. This mixture is heated on a sand-bath, until the whole of the sulphate of iron is peroxidised, and a dark brownish red liquor is obtained, which, after having become quite cold, is added to the solution of 100 grms. of sulphate of iron. The author next proceeds to make a boiling concentrated solution of either caustic potassa or soda, and, while this is kept boiling, the mixed solution of iron salts is cautiously added, drop by drop, to the alkaline liquid. In this manner a very beautiful magnetic oxide of iron is obtained, which, on account of its great density, is easily washed with previously well boiled, and still hot, distilled water. After washing, it should be carefully dried over sulphuric acid. After having been thus well dried, the author found, on analysing it, that its composition corresponds to the formula $FeO+Fe_2O_3+HO$. When dried by means of heat, gradually applied, the water is eliminated, and oxidation at the same time sets in; and when the substance is entirely dry, it is, also, entirely converted into Fe_2O_3. The quantity of water contained in the air dried (over sulphuric acid) magnetic oxide, amounts to 7·20 per cent. The composition of the chloride of this magnetic oxide, a perfectly well-defined salt, is, in 100 parts:—Chlorine, 36·57; iron, 21·66; water, 41·77. Formula, $4Cl3Fe18HO$; or—

$$4Cl\left\{\begin{matrix}Fe\\Fe_2\end{matrix}\right\}+18HO.$$

The author has also succeeded in obtaining a sulphate; but the stability of these salts is, after all, very slight.

Synthesis of Phenol.—M. Berthelot.—The author has combined acetylen with fuming sulphuric acid, thereby forming acetylenosulphuric acid, which is not decomposed even by boiling water. The author has next prepared acetylenosulphate of potassa; and, on decomposing this salt, phenol was obtained in large quantity. Acetylenosulphuric acid should not be confused with acetylsulphuric acid, which is a totally different body, and readily decomposed, even by cold water.

Utility of Common Salt as Applied to Agriculture.—M. Peligot.—This lengthy paper is chiefly written with the view of criticising a paper published some time ago by M. Velter, "On the Utility of Common Salt to Agriculture, in consequence of its Ulterior Transformation into Carbonate, and, lastly, Nitrate of Soda." The chief result of M. Peligot's researches is, that when common salt naturally occurs in an arable soil, some plants assimilate this salt, but the greater number leave it unassimilated.

Milk met with in Algeria.—M. Commaille.—This paper contains the results of a series of analyses of milk from cows, goats, and sheep, taken at different periods after the birth of the young of these animals, while care is taken to ascertain the various races these different beasts belong to. Goat's milk, general average—Butter, 45·25; caseine, 35·34; lactine, 49·32; lactalbumine, 8·27; lacto-proteine, 1·90; ash, 7·77. Sheep's milk—Butter, 53·75; caseine, 41·85; lactine, 44·94; lactalbumine, 11·30; lacto-proteine, 3·16; organic acids, 4·63; ash, 9·22. The chief result the author points out is, that the milk in Algeria is better, that is to say, richer, especially in nitrogenised compounds, than the milk met with in Normandy and the Elsass.

On a Milk Mushroom (Champignon).—M. Hesling.—The author points out that, even long before milk becomes sour, there are generated in it very small organised spores of an *ascophora* species.

Annalen der Physik und Chemie, von Poggendorff, No. 8, 1869.

This number contains the following original papers and memoirs:—

Researches on the Impact of a Jet of Water.—Dr. Buff.—This is a very lengthy physico-mechanical essay, not bearing in any way upon chemical science. The makers of fire engines will find much interesting matter in this paper.

Limits of Magnetisation of Iron and Steel.—Dr. von Waltenhofen.—A monograph on this subject, the contents of which are entirely of a mathematico-physical nature.

Some Double (Tisin) Crystals of Sulphuret of Iron (Iron Pyrites).—Dr. Hessel.—This is a purely crystallographical essay on this subject, illustrated by a series of engravings.

Regular Cavities which Naturally Occur, or may be Artificially Produced on the Planes of the Crystals of Quartz.—Dr. J. Hirschwald.—Also a purely crystallographical essay, illustrated by several engravings.

Researches made for the Purpose of Determining the Electromotoric Force between Water and some Metals, by means of the Galvanic Compensation.—Dr. E. Gerland.—A mathematico-physical essay.

Meaning of Insulators in the Theory of Electricity.—M. Schwedoff.—This is the continuation of a lengthy monograph on this subject commenced two volumes previously; it is entirely a mathematico-physical essay.

Transversal Magnetismus of Iron and Steel.—Dr. E. Villari.—A very lengthy monograph, very concisely written, and purely mathematico-physical in its contents.

Researches on the Behaviour of Vapours towards the Law of Marriotte.—Dr. Herwig.—The second part of an extensive monograph on this subject, too lengthy and too abstrusely written to be fit for abstraction.

Meteorite of Krähenberg, near Zweibrücken.—M. E. Weiss.—This paper does not contain anything new on this subject, of which we gave an abstract of a paper taken from a previous number of this periodical (CHEMICAL NEWS, vol. xx., p. 83).

Observations of Solar Protuberances.—M. Zöllner.—We regret that we cannot extract this paper, as it is copiously illustrated with ten very beautifully executed coloured engravings, which are absolutely required for the proper understanding of the subject.

Evolution of Heat Caused by the Emission of Sound from Solid Bodies.—M. E. Warburg.—A purely physical essay.

American Journal of Pharmacy, September, 1869.

We learn from this number of the death of Prof. H. E. Dussauce, which took place at New Lebanon, Columbia County, N.Y., on the 20th of June last. The deceased, who was born on the 25th of December, 1829, at Paris, was a pupil of Chevreul, and was for a time one of the Professors of Industrial Chemistry in the Ecole Polytechnique. The deceased occupied the position of chemist in Tilden and Co.'s Laboratory, and was one of the editors of the *Journal of Applied Chemistry*, and the editor of several other works. The deceased was well known in Europe as an eminent technologist and an excellent analyst.

This number contains the following original papers and communications on subjects of scientific interest for chemists. We omit some papers relating to the practice of pharmacy, of which it should be said, however, that they highly deserve the attention of those concerned:—

Critical Note on Permanganate of Potassa as a Test for Distinguishing Chlorine, Bromine, and Iodine.—Mr. G. Macdonald.—The author has investigated this subject carefully, and made a series of experiments, the main results of which are, that this method of distinguishing, by means of the reaction produced by permanganate of potassa, between the three haloids above named, is only applicable to very dilute solutions, and, even then, care must be taken that the permanganate of potassa is also in very dilute solution, and added drop by drop, as any excess beyond what the iodide or bromide would decompose would be apt to give the liquid its own characteristic tint. Moreover, the method is applicable to simple solutions of haloid salts, and its use implies some previous knowledge by the operator, both of the composition and the strength of the solution under examination. In a compound solution of a chloride and iodide, this test, *per se*, would be of but little use, as only the presence of the iodide would be indicated, and recourse to other methods would be necessary for the detection of the chloride. In a solution containing no haloid whatever, as, for example, a solution of a nitrate or a sulphate, this test would indicate the presence of a chloride—that is, no change would be produced on the addition of the permanganate. In a solution containing organic matter, the test would, in many instances, be rendered worthless, since the permanganate is readily decomposed by such substances, with changes very similar to those produced by the action of iodides or bromides.

Sulphur in Louisana.—The Louisana Petroleum Company, while boring for oil near Lake Charles, reached, at a depth of 442 ft., strata of crystallised sulphur, some 2 ft. thick, and of very pure quality. On boring farther downwards, the augur passed, for a distance of 90 ft., through limestone rock, which yielded about 50 per cent of sulphur, with occasional strata of 6 to 8 feet in thickness of pure sulphur. The boring has now reached to a depth of 600 ft. The Company intend to begin mining operations for the extraction of sulphur, but the cost of such work cannot fail to be very large; yet it appears that there is so great a demand for sulphur in the States that mining it at this depth will pay.

Zeitschrift für Analytische Chemie, von Dr. C. R. Fresenius, second number for 1869.

This number contains the following original memoirs and papers:—

Preservation (Storing) of Solutions of Protochloride of Tin, Sulphuretted Hydrogen, and the like.—Dr. F. Mohr.—The keeping of large quantities of titrated solutions is what is meant by the author, who advises that such solutions, after having been made in large quantity, should be poured in bottles provided with a tubulure at the bottom, through which a perforated cork, into which a downward-bent glass tube is fitted, and that this tube should be connected with another longer tube, by means of india-rubber fittings, and so arranged as to admit of running fluid into a burette; the neck of the bottle is fitted with a perforated cork, wherein a narrow glass tube is inserted. In order to prevent the action of the air upon the fluid contained in the bottle, a layer of petroleum, 1 centimetre high, is poured on the fluid. Saturated aqueous solution of sulphuretted hydrogen may be preserved in the same manner; but the bottle containing it should be kept in a cool place, and not exposed to direct sunlight.

Analysis of Ferromanganese.—M. Darmstadt.—Ferromanganese is a peculiar variety of iron which contains a large quantity of manganese. The general plan of analysis followed in this instance by the author is the same as that published in Fresenius's last edition of "Qualitative Analysis"; the estimation of the carbon was made by Berzelius's method, dissolving the iron in neutral chloride of copper. The result of the analysis quoted, percentically, is:—Iron, 73·474; manganese, 21·064; cobalt, 0·007; zinc, 0·062; copper, 0·072; lead, 0·011; aluminium, a trace; titanium, 0·011; calcium, 0·175; magnesium, 0·035; arsenicum, 0·001; antimony and tin, 0·030; phosphorus, 0·109; sulphur, a trace; silicium, 0·059; carbon, 4·805.

Separation of Oxide of Uranium from Phosphoric Acid.—M. Reichardt.—The author refers to the separation of phosphoric acid from oxide of uranium where the latter is used in large quantity for the estimation of phosphoric acid. Dissolve the phosphate of uranium in hydrochloric or nitric acids, apply heat, add excess of chloride of iron, and, next, excess of solution of carbonate of soda; wherein, aided especially by the large quantity of carbonic acid which is thus set free, the oxide of uranium is readily dissolved, while the phosphoric acid is combined with the oxide of iron. The solution of oxide of uranium in carbonate of soda is acidified with hydrochloric acid, boiled to expel carbonic acid, and the oxide of uranium next precipitated with ammonia.

Estimation of Organic Matter and Nitric Acid in Well Waters.—M. Reichardt.—This paper is chiefly a review, criticising the value and reliability of a number of methods for the quantitative estimation of organic matter and nitric acid in potable water. From this paper we incidentally learn that the water of the well of the house, No. 42, Gerichtstrasse, Berlin, contains, in 1 litre, 0·675 grm. NO_5. The average of twenty-seven different samples of well-water of Liepzig is 0·346 grm. to the litre. The water of the waterworks of Liepzig contains 11·5 parts of NO_5 in 1,000,000 parts of water.

Modification of the Piknometer.—Dr. Gintl.—Since, without the woodcuts annexed to this paper, its contents could not be clearly understood, we only quote the title.

Estimation of Phosphoric Acid in the shape of Pyrophosphate of Magnesia.—Dr. Kubell.—This paper is a concisely written treatise, divided into two sections—the first of which treats of the solubility of the ammoniacal phosphate of magnesia in water containing ammonia; the other section treats of the precipitate caused, in an ammoniacal solution containing phosphoric acid, by excess of solution of magnesia. This treatise does not admit of suitable and useful condensation.

Changes Albuminates Suffer when they are Submitted to the Action of Water.—Dr. W. Schmidt.—Albumen, prepared from serum of blood, casein, fibrin, and other similar materials, were submitted, in sealed tubes, to the joint action of a high temperature, ranging from 135° to 150°, and water, in order to test the correctness of M. Meissner's statement that these materials yield, when so treated, peptones. This, however, is not the result of the author's researches, which have not brought to light any other results than those generally known on this subject.

Improvement of the Volumetrical Estimation of Copper and Zinc contained in Ores by means of a Standard Solution of Ferrocyanide of Potassium.—M. Galetti.—This paper is reserved for full translation.

Description of an Improved Apparatus for the Evolution of Sulphuretted Hydrogen.—Dr. Seelhorst.—Without the engravings annexed to this paper, it cannot be well understood.

Peculiar Appearance Shown by the Flame of Burning Hydrogen.—Dr. Seelhorst.—The author has repeated Barett's well-known experiments of holding in the flame of burning hydrogen gas very well cleaned glass rods, metals recently cleaned by filing them just previous to the holding in the flame, and has observed the same blue colouration as M. Barett did. But the author is not at all inclined to ascribe this colouration to the effect of burning sulphur, which should be so generally spread about in the shape of some sulphate, as to produce this colouration. The author, though abstaining from stating any precise cause at all, inclines to the belief that the cooling effect of the cold body held in the flame has something to do with this phenomenon. Perfectly pure hydrogen, burning from a platinum burner, as well as from iron or glass burners, exhibited the phenomenon, when cold bodies, just after having been cleaned by scraping or filing, were held in that flame. These experiments were conducted in a laboratory, repeated in a lecture-hall, and in the taproom of a *café* with the same result.

Estimation of Lime and its Separation from Magnesia when Dolomites are to be Analysed.—Dr. A. Cossa.—The author's object has been to determine what the accuracy is of estimating lime as quicklime or caustic lime, instead of weighing it as carbonate of lime. The experiments were made—(1) With pure oxalate of lime previously dried at 100°; (2) with carbonate of lime precipitated from a solution of pure chloride of calcium by means of pure

carbonate of soda; (3) with pure, native carbonate of lime, Iceland spar. The result of an average of three experiments with No. 1 is 0·07 per cent too low; with No. 2, 0·35 per cent too low; with No. 3, 0·47 per cent too high. As regards the analysis of dolomite, the author states that, when care is not taken to re-dissolve the precipitate of oxalate of lime first obtained and re-precipitate this a second time, it is always so contaminated with oxalate of magnesia or ammonio-oxalate of magnesia that the quantity of lime found as carbonate may be 0·62 per cent in excess of what it ought to be, while the loss for carbonate of magnesia may even be as high as 0·78 per cent.

Analysis of Soft Lead.—Dr. Fresenius.—This paper or treatise is an exhaustive monograph on the analysis of refined lead and the estimation therein by volumetrical methods of iron, copper, zinc, antimony, and other metals. This treatise, as might be expected from the eminent author, is as complete as can be desired, but it is too lengthy and too concisely written for useful abstraction.

Comparative Researches on the Estimation of Phosphoric Acid.—M. Kissel.—The author treats on the gravimetrical and volumetrical methods in use for the estimation of this acid. (*a*) Direct estimation as pyrophosphate of magnesia; average result of three carefully conducted experiments, 99·53 per cent; result by the same method, but with the correction required for the solubility of the ammonio-phosphate of magnesia in ammoniacal water, average of three experiments, 100·22 per cent. (*b*) Indirect estimation as pyrophosphate, following a previous precipitation as molybdo-phosphate of ammonia; average result, without correction for solubility of ammonio-phosphate of magnesia, 99·09 per cent, with that correction, 99·79 per cent; estimation (gravimetrical) as phosphate of oxide of uranium; average result, 100·33 per cent; estimation as basic phosphate of iron; average result, 99·68. Volumetrical methods: Average result of four experiments with acetate of oxide of uranium, 100·12 per cent. The author has purposely made a series of experiments in order to ascertain the influence of repeated solution and re-precipitation of the ammonio-phosphate of magnesia, obtained in quantitative research, also the influence of excess of ammoniacal salts and the action of dilute ammonia upon pure ammonio-phosphate of magnesia, the results obtained do not materially differ from what is generally known on this subject and published thereon in works on analytical chemistry.

Application of the Principle of Areometry to Quantitative Chemical Analysis.—Dr. Gintl.—The plan devised by the author is extremely ingenious, and deserves the attention of analysts; but we cannot condense his paper or make the principle even understood without the reproduction of some engravings absolutely necessary for the explanation of the subject.

Detection of Bitter Substances other than Hops in Beer.—M. L. Enders.—In order to separate lupuline from quassiine, absynthiine and menyanthine, the author proceeds as follows:—Alcohol is applied to separate gum, a mixture of strong alcohol and ether to separate sugar from beer; the solution of bitter substances is next treated with acetate of lead; a precipitate ensues which contains lupulin and hop-resin; treat precipitate with H_2S, separate PbS, wash with alcohol, evaporate the filtrates to dryness, exhaust residue with chloroform, and repeat this operation, adding a large quantity of warm water; evaporate chloroform when the hop-resin is left as an insoluble matter in the water, which, after separation of this resin, is also evaporated to dryness; the residue has a bitter taste; exhibits when dissolved in water an acid reaction to test paper; is soluble in alcohol, ether, and chloroform; the weak alcoholic solution is precipitable by acetate of lead, but not by tannic acid; does not give, when treated with ammoniacal silver-solution, a deposit of metallic silver. These characters indicate lupuline. The filtrate from the solution above alluded to is freed by means of H_2S from excess of lead, the sulphide of that metal removed by filtration, the filter washed with hot water, and the filtrate heated in order to expel sulphuretted hydrogen gas; and next, a solution of tannic acid is added; in case a precipitate ensues, it is collected on a filter, some pure carbonate of lead is added to the precipitate while yet wet, and the mass is dried, next boiled with alcohol, the filtrate therefrom evaporated to dryness and exhausted with pure ether. This ethereal solution is evaporated to dryness, the residue is either soluble in alcohol, or in a large quantity of hot water, the aqueous solution is precipitable by means of tannic acid, not by acetate of lead; the precipitate is first mixed with concentrated sulphuric acid, and, on addition of some water, yields a bluish violet colour. The substance boiled with ammoniacal solution of silver yields a metallic mirror: these characteristics indicate absynthiine. The residue insoluble in ether is soluble in alcohol; this solution, after having been diluted with water, is precipitable by tannic acid, not by acetate of lead; the substance, on being heated with ammoniacal solution of silver yields a metallic mirror, indicating menyanthine; absence of metallic mirror indicates quassiine.

Cosmos, September 4, 1869.

Origin of the Alkaline Chlorides found in the Water and Rocks of the Coal-Formation of Luijk, Liège (Belgium).—M. Malherbe.—After referring to the doubts existing about the question whether the plants which have given rise to the coal-fields have been submerged by fresh or salt water, or by a mixture of both, the author contends that, as far as the coal-basin above named is concerned, his opinion is that the plants which served to form the coal, were submerged in a mixture of fresh and salt water, since not only the water pumped up from the pits in the locality mentioned contains a large proportion of alkaline chlorides, but the rocks in that part of the country also contain a considerable quantity of these salts. The author's opinion is not shared by the well-known eminent Belgian geologist, M. Omalius d'Halloy, who states that coal has been formed in a similar manner as peat is at the present day, in stagnant fresh water; but the presence of the alkaline chlorides is accounted for, by later irruptions of the sea, and by the many commotions the coal formations have been subject to long after they were formed.

Revue Hebdomadaire de Chimie, September 2, 1869.

This number contains an excellent description of—

The Freezing Apparatus Invented by M. Toselli.—The author applies freezing mixtures made up without the addition of acids, and chiefly prefers the following salts:—Nitrate of ammonia, carbonate of soda, sal-ammoniac, and chloride of potassium, mixed in certain quantities together. The mixture best adapted for his apparatus is made up of equal parts of nitrate of ammonia, carbonate of soda, and water, wherewith a lowering of temperature of −33° can be obtained. Without the reproduction of the woodcuts annexed to this paper, it would be useless to try to describe the apparatus applied by the author, who conducts, at Paris, a business, on a large scale, for the artificial production of ice, and the sale and making of his apparatus and the salts used for the production of cold. According to all accounts, his invention is the best and most applicable of the kind hitherto made.

Les Mondes, September 9, 1869.

The Deepest Artesian Well in the World.—If the American reporter of this periodical is well informed there exists at Saint Louis, U.S., an artesian well, which, as far back as the year 1854, had been bored to a depth of 2199 feet, without reaching water bearing strata. In 1865, the previously suspended borings were resumed, and are yet pushed forward; but though a depth of 2852 feet has been reached, no water bearing strata has been found. The borings now proceed only about three inches depth every day, in compact solid granite, and the cost per month amounts to 1600 dollars.

NOTES AND QUERIES.

Estimating Ammonia.—In answer to the query of "*A. Z.*" (CHEMICAL NEWS, vol. xx., p. 156) respecting a ready commercial method of estimating the percentage of ammonia in sulphate of ammonium, I beg to say that the readiest and most reliable method for this purpose is as follows:—Place a known weight of the salt in a flask fitted with cork and bent tube with bulb (the bend and the bulb are to prevent spirting and carrying over of any caustic liquor by the steam), and, having dissolved in a small quantity of water, distil, with a strong solution of caustic soda, potash, or milk of lime, into a beaker containing a known volume of a titrated solution of hydrochloric acid. The liquid in the flask is boiled till two-thirds are distilled over into the acid, which must be kept cool by immersing the beaker in a vessel of cold water, and keeping a stream of water circulating through the latter during the experiment. The tube is now carefully withdrawn from the acid, still keeping the lamp under the flask, or the contents of the beaker would immediately be sucked back. Just as the tube emerges from the liquid, it is well rinsed with the wash-bottle. The partially-neutralised solution in the beaker is washed out into a basin, tincture of cochineal added, and then the excess of hydrochloric acid is determined at once, in the cold, by means of a sodic carbonate solution of exactly equivalent strength to the hydrochloric acid. The volume of sodic carbonate solution subtracted from that of the hydrochloric acid equals the volume of acid solution required; and the HCl solution should, for the sake of rapidity of working, be so graduated that the number of volumes required should equal the percentage of NH_3 in the salt. If pyrites has been used in the manufacture of vitriol, the vitriol is contaminated with anhydrous persulphate of iron (as a white deposit, which disappears on dilution), and also with a large quantity of arsenic: if, then, iron and a comparatively large quantity of arsenic be found to exist in a sample of vitriol, I think "*A. Z.*" may take it for granted that pyrites has been used in this case. This method is applicable for the estimation of ammonia in any of its salts, providing that these be free from any organic nitrogenous matter. The caustic solutions (potash, soda, or lime-milk) should be well boiled previous to use, and allowed to get quite cold again: this is to free them from all traces of ammonia. In a subsequent communication, I will give the methods for the calculation and construction of volumetric solutions, from which the percentages may be immediately ascertained as being identical with the number of volumes of such volumetric solutions required.—WATSON SMITH, F.C.S., West Gorton, near Manchester, Sept. 27, 1869.

TO CORRESPONDENTS.

Enquirer.—We do not know if Professor Jellett's paper has been published or not.

A Constant Subscriber.—We know of no book treating on the proximate analysis of bodies only, but it is treated of in Watts's "Dictionary" under the word "analysis."

A. B. C.—(1) A new work on Dyeing is in the press; (2) Reimann's work on Aniline, price 10s. 10d., post free from our office; (3) Apply to Professor Calvert, at the Royal Institution, Manchester; (4) Animal mordants will fasten aniline dyes on cotton.

THE CHEMICAL NEWS.

VOL. XX. No. 515.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 159.)

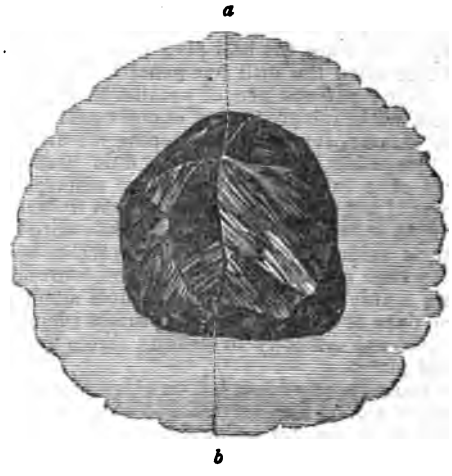
THE subject of the present chapter may be considered rather as mechanical than microscopical; in fact, it relates more to the workshop than to the study. It may, perhaps, seem strange to write about making apparatus and preparing materials in these days when nearly everything can be bought often better and more cheaply than it can be made at home, and when it is not as it was within the memory of many microscopists, who were obliged to cut their glass slides, or, at all events, to order a glazier to make them: but the more dexterous a person is with his fingers the better microscopist he is likely to make. Very often the success of an observation depends upon the observer being able to make some little contrivance to aid his researches, and it is for that purpose that the subject of the mechanics of the microscopical laboratory finds a place here.

The first material that engages the attention is glass. It comes under notice in several forms—the plates of glass upon which objects are mounted, the thin covering glass, and glass tubing. The glass generally used for mounting objects is a description of glass known as patent plate. Crown glass is sometimes used, but patent plate is perhaps the best. It is made from that commonly known by the name of cylinder glass, which is manufactured by the glass being blown, first of all, into a globe, then, by dexterous manipulation on the part of the workman, it is elongated, and a cylinder is formed. This cylinder is ripped up, and put in an annealing oven: it unbends at the slit, and rolls itself out flat. In this state it is known as sheet or flatted glass. The glass then undergoes the same treatment as plate glass. It is ground down and polished, and then it becomes the patent plate. It is a thin glass, with a beautiful surface, so accurately worked that the plates will adhere together if pressed, just as good specimens of ordinary plate.

The tool used for cutting glass is the well-known glazier's diamond. It seems to have nothing in common with ordinary cutting tools: an incision or scratch with a diamond or other instrument, such as a flint or chilled-steel point, will not make the clean fracture we are so familiar with when the cutting diamond is used by a skilled hand. The diamond would seem rather to act by inducing some molecular displacement than by any actual penetrative power that it possesses. This view would seem to be supported by the appearance presented by the glass adjacent to a diamond cut when examined by the microscope with the aid of polarised light, which shows that the glass has been subjected to some kind of strain. Rubies and sapphires, if worked to the form of the natural edges of the diamond crystal, will cut glass, but lose the power when the curved edge wears away. A very interesting paper on the fracture of glass and the action of the diamond, by Mr. F. H. Wenham, will be found in the *Microscopical Transactions* for 1868, p. 105. (See also *Holtzapffel*, "Turning, &c.," vol. i.)

There is some little art in using the cutting diamond: it is not any part of a diamond that will cut. It is very easy, indeed, to scratch with a diamond, but it is only in certain directions that it will make the so-called cut. The glazier's diamond (Fig. 13), when viewed under the binocular microscope, will be found to exhibit a well-defined and slightly curved edge, *a*, *b*. The diamond is carefully set so that this edge (which is a natural crystalline one) lies parallel with the oblong mounting, and, as the diamond requires to be held in an inclined position to secure a clean cut, the top of the setting is always bevelled to the proper angle. It is allowed a little play horizontally on a pivot, so that, upon placing the diamond in contact with a rule, it will always place

FIG. 13.



itself in the cutting direction, and, by keeping the end of the setting parallel with the glass, it will be in a position for cutting. It is then drawn along; and those who have seen a glazier cut glass will remember the curious noise which accompanies the operation—something between a ringing and a hissing: the sound is very different from a scratch. The glass breaks at the place upon being bent. With a little practice, the cutting of glass will be very easy indeed; but it is not worth while, as a general practice, to cut slides, as they can now be bought at a cheap rate: it is chiefly for exceptional purposes that facilities for cutting glass are of value. Sometimes a piece of glass of extra size or unusual shape is required, and then time is often saved by being able to do the work, instead of waiting until the services of a glazier can be obtained.

The other kind of glass employed in mounting objects is the thin glass for covers. The details of its manufacture are unknown to me. It is remarkable for its extreme brittleness. In cutting, the glazier's diamond is not employed, but a splinter known as the writing diamond. The operation is attended with some difficulty, as the glass is

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

very likely to crack and star under the diamond. This is best prevented by placing the thin glass to be cut on a piece of wet plate-glass, which affords support, and effectually prevents splitting and cracking. As in the case of the 3×1 slides, it is hardly worth while to cut up squares and circles of thin glass, as it can be easily procured of the opticians already cut into the most useful sizes, or, if required in large quantities, of the wholesale glass warehouses. Of course pieces of unusual sizes and shapes are sometimes required, and then the power of cutting becomes of value.

The writing diamond is also used for making marks and writing on glass. Some persons write the names of their objects on the glass instead of on a label: it has the advantage of durability, but is not so legible as an inscription on paper.

Sometimes it is required to drill a hole in a piece of glass. This is a matter of no very difficult accomplishment. A good hard drill, if it is kept moistened with turpentine, will, with a small amount of patience and labour, eventually work its way through a piece of glass. Care should be taken that the glass rests upon a cork bed, or something soft, but yet firm, to give it sufficient support, or it may break just before the point of the drill makes its way through. Perhaps the best plan is to begin on the other side when the drill has penetrated about halfway. Some persons are of opinion that dilute sulphuric acid, in the proportion of eight parts of water to one of acid, serves for moistening the drill better than turpentine. Of course the fluid used is the reverse of a lubricant: if oil were employed, the drill would not cut. The drills are best hardened by heating to redness and cooling suddenly with strong sulphuric acid. The edge requires working up from time to time upon an Arkansas stone, with oil. In drilling a thick piece of glass, the drill may require setting once or twice during the process; but I have never had any difficulty in drilling through a thick piece of plate.

The rough, sharp edges left on glass after cutting with the diamond may be removed by grinding with fine emery and water upon a smooth paving-stone or thick plate of zinc: the glass-cutters usually employ emery upon a lap or horizontal wheel.

For many cutting processes, tools made of corundum and shellac are very useful; this composition, in the form of wheels, files, hones, &c., of several degrees of fineness, can be obtained of Mr. D. Lyon, 43, S. John's Square, Clerkenwell, E.C. These tools, especially the wheels, are employed by dentists, in cutting and shaping the semi-vitrified porcelain used in the manufacture of artificial teeth. The use of the corundum composition in this country is comparatively recent, although it has been employed for centuries by the native jewellers of India.

Corundum is a crystalline mineral, identical, or nearly so, in composition with the sapphire, ruby, topaz, and amethyst, equally hard, but wanting in transparency and lustre. Emery is nearly similar, but occurs in a granular form, and does not cut so well, although there are many purposes for which it is more serviceable than the harder corundum.

These tools must be plentifully supplied with water when in use, as, unless kept cool, they soon lose their shape, which would be the case if used dry, as they would rapidly heat and melt with the friction of rasping and grinding a hard substance.

Glass plates may be smoothed, and even rounded at the edges, with the greatest ease, with a corundum file, and almost as quickly as brass could be filed. A tapering tool is useful for enlarging a hole drilled in glass; and the hones serve for grinding sections of substances too hard for the ordinary stones. As the material becomes better known, many other uses will, no doubt, be found for it.

Glass is frequently used by the microscopist in another form, that of tube. It is chiefly employed in making the dipping tubes, with which objects such as free swimming animals and deposits in water are taken up, and for the pointed tubes, or pipettes, with which small portions of fluids are removed and deposited where they may be needed. The manufacture of these bent tubes, or pipettes, is not a matter of difficulty. The processes of drawing glass tube to points, and bending, are very frequent in the laboratory. The best source of heat is obtained from the Bunsen burner, which gives a very large flame without smoke and of great heating power by the consumption of a mixture of air and coal gas. It can be obtained of the chemical instrument makers for a very small sum; a spirit lamp, however, will answer the purpose tolerably well if the wick is a large one. A piece of glass tube, in which it is intended to make a bend, should be heated to a slight redness, and then carefully and slowly bent to the required angle. If an attempt is made to bend a tube suddenly, it will produce a choke, or contraction, in the bend. It is also necessary to heat a considerable length of tube. Pieces of glass tube are very easily detached, by making a notch on them with the edge of a file, and they are then sure to break straight across; any length of glass tube can be cut off in this way. The process most frequently required to be performed by the microscopist is the drawing tubes out into pointed ends for pipettes. To effect this, heat the tube in the flame; when the tube has become sufficiently soft, it can be drawn out to any length and fineness you please. The rough edge at the cut ends of tubing may be taken off by heating the ends in the flame, which will melt the edges and leave them rounded. This rounding of the edges is, perhaps, effected more rapidly by using a blowpipe, which facilitates the fusion of the glass. Sometimes a pipette curved as well as pointed is required; there are many purposes for which it is extremely useful. This is easily made by a little variation of the other process; while it is being drawn out, give it a skilful bend at the proper moment. Always keep tubes of glass revolving while they are being heated, and do not heat them more than is absolutely necessary, as, when the tube is made very hot, it is extremely pliable, and likely to lose its shape. With a little ingenuity a number of useful things may be made out of glass tube. A variety of these pipettes will be found useful, and they are rather expensive to buy.

Glass, whether in the form of slides or thin glass, always requires cleaning. The best cleaning fluid is methylated spirit, which, as it is not subject to duty, and can be obtained cheaply, may be made free use of for this and nearly all the operations of the microscopist in which strong alcohol is required. Care must, however, be taken to obtain pure methylated spirit, and not what is commonly known as "methylated finish," which contains a small portion of shellac in solution, and is quite useless for all microscopical and laboratory purposes, and which is not unfrequently sold when methylated spirit is enquired for.

I am indebted to the Rev. J. B. Reade for the history of this adulteration. Formerly, methylated alcohol was allowed to be sold without a licence; but certain persons, finding that it was cheap, and not being particular about the flavour of methylic ether, used it for making grog. This fact coming to the knowledge of the excise authorities, its sale by unlicensed dealers was prohibited, unless containing shellac in solution, a mixture which would not spoil it for its chief use, that of varnish making, while, upon mixture with water, the gum would be precipitated, making a very disagreeable turbid compound. There is no difficulty in obtaining pure methylated alcohol in large towns, where one or more licensed dealers are generally to be found. It can be obtained perfectly pure, either in large or small quantities, of Messrs. Jackson and Townson, Bishopsgate Street, and of most other dealers in chemicals. It should not leave any residue upon evaporation, or become turbid when mixed with water; any spirit having these defects should not be used for microscopical purposes.

Great care should be taken that the cloths used for cleaning glass be perfectly free from soap or dirt, otherwise they will leave the surfaces of the slide covered with striæ. Old linen, or cotton cloths, are to be preferred to new ones; they should, before use, be boiled in water and common washing soda, to remove all soap left from former washings. They are then to be washed several times in clean water, until all trace of the soda is removed, and then dried, but not ironed, as the rough fluffy condition they will be left in is extremely favorable for cleaning glass. After the spirit is cleaned off with the cloth, any fibres that may be left from the cloth should be removed with a soft wash-leather.

Thin cover glass is treated in a similar manner, but, on account of its excessive brittleness, requires great care in cleaning. After a little practice, it is quite easy to rub it with the cloth and leather between the thumb and finger; but, should any difficulty be experienced, which may be the case with the thinnest kinds, it will be found that it can be rubbed with considerable force, without injury, between two discs of wood covered with wash-leather. The great thing in rubbing a brittle substance is to support it well behind; this is the whole secret of cleaning thin glass between the finger and thumb.

For joining together pieces of glass, and for attaching metal to glass, the cement known as marine glue is usually employed. It consists of india-rubber, shellac, and coal naphtha, combined in various proportions, according to the purpose for which it is intended to be used. It is, I believe, difficult to make in small quantities; but there is no trouble in obtaining it, as it is sold by most microscope makers. As this cement will only adhere to hot surfaces, it is necessary to have some means of applying a steady heat to the pieces of glass, &c., to be joined; and as this cannot be done by means of the unprotected flame of a lamp, a hot-plate is generally employed. This can be obtained, ready made, of the opticians; but a piece of thick brass plate, about 6 or 7 inches long and 2 inches wide, placed upon one of the rings of a retort stand, will answer admirably; it can be heated by means of a spirit lamp or gas flame placed underneath. Supposing, for example, it is required to attach a ring of glass or metal to a glass slide, to form a cell for an object to be mounted in. The glass slide is placed upon the hot-plate, first of all, at the part most distant from the lamp, to avoid breaking it by too sudden heating, and then moved gradually to the hotter part; the ring is also heated on the plate, a piece of marine glue is held on the point of a needle in a handle, or other convenient holder, and rubbed on the heated glass over the surface to which the ring is to be attached. When a sufficient portion of glue is melted on the glass, care being taken to heat the glue sufficiently for free working, while overheating amounting to boiling is to be avoided, the heated ring is then lifted on with a pair of forceps, which, for this and all purposes where they are likely to be made hot, should be of brass, or else an old pair of steel forceps, which are to be kept for such uses. The ring is then to be turned round backwards and forwards on the glass, to spead the cement equally, and then removed from the hot-plate and pressed on a piece of wood, to expel superfluous glue, and allowed a little time to set; when set, but still warm, the greater part of the cement can be scraped off with a blunt knife, a process much more difficult if it is allowed to become quite cold. A number of cells can be attached and roughly cleaned at one time, the plate next required being heated while the one cemented is being cleaned off. When quite cold, the slides can be thoroughly cleaned with a piece of rag and a free use of methylated spirit; they should then be rubbed bright with a clean cloth. Some persons use liquor potassæ for cleaning off superfluous marine glue; it does this very effectually, but not so rapidly as strong alcohol, and the operation is a rather unpleasant one, as the alkaline solution first softens, and then removes the skin from the fingers.

The adhesion of marine glue, and other cements, to glass surfaces, is much improved by grinding, which gives the cement a better hold than it would have on a polished surface, although marine glue will adhere well to polished glass, provided the surface is free from grease, which may be insured by a cleaning with methylated spirit. The adhesion of two pieces of glass cemented with marine glue is so perfect that they generally break in any place rather than at the joint.

(To be continued.)

ON THE

SOLVENT TREATMENT OF URIC ACID CALCULUS

AND THE

QUANTITATIVE DETERMINATION OF URIC ACID IN URINE.*

By the Rev. W. V. HARCOURT.

When the British Association met at Manchester in 1861, Dr. Roberts, Physician to the Royal Infirmary of that city, communicated a paper respecting "The Power of Strong and Weak Solutions of the Alkaline Carbonates on Uric Acid Calculi,"† in which he showed the fallacy of the experiments supposed to have proved their inefficacy in a report formerly made to the French Academy by MM. Gay Lussac and Pelouze.

Dr. Roberts found that solutions of the carbonated alkalies containing more than 120 grains of the salt in a pint of water arrested their own action by forming an

* Read before the British Association, Exeter meeting, Section B.
† "Report of the British Association, Manchester, 1861," p. 90.

insoluble crust of biurate on the calculus, and that the maximum of solvent power lay in solutions which contain 50 or 60 grains in the pint. At this strength, no incrustation was formed when the carbonate of potash was employed; and 21·4 grains per cent of the weight of the calculus were removed by a flow over it of 6 pints in twenty-four hours. The carbonate of soda followed the same general course, with inferior efficacy.

In 1865, Dr. Roberts communicated to the Royal Medical and Chirurgical Society of London* a paper in which he showed, by a series of well-devised experiments, how this discovery might be applied, with a reasonable prospect of advantage, to medical practice; and laid, for the first time, a scientific basis for attempts hitherto empirical and contradictory at dissolving the stone. The most remarkable of these experiments was that in which he passed the urine of a patient who was taking citrate of potash at the rate of 40 grains in 5 ounces of water every two hours over a fragment of uric calculus, and, by this process, reduced it in twelve hours from 180·5 to 174 grains, or at the rate, in twenty-four hours, of 13 grains.

In July, 1868, I was made aware, by an eminent surgeon, Mr. Spencer Wells, of the presence of a stone in the bladder, one diameter of which appeared to measure 1½ inches; and I was advised by Mr. Wells (and by Sir H. Thompson, who confirmed his opinion as to the size of the stone), to aim at preventing its enlargement by such doses of citrate of potash as might keep the urine in a state approaching neutrality. In conversation with my excellent friend, the late Mr. Hodgson, who, when surgeon to the Birmingham Hospital, had had great experience in this complaint, I learned that he had met with so much success in the application of an empirical medicine of much celebrity, manufactured in that neighbourhood, and consisting of carbonates of potash, that, in any case of uric acid calculus, he would advise the experiment of its administration.

Mr. Wells afterwards drew my attention to the experiments of Dr. Roberts, which appeared so satisfactory that I determined to make trial of his method of treatment, and to ascertain, if possible, by chemical analysis, the excess of uric acid above the normal quantity contained in the urine which it might be considered as removing from the calculus.

I felt the great importance of the inquiry, and had the advantages of more than ordinary leisure, a long familiarity with chemistry, a well-furnished laboratory, and an assistant in executing the experiments on whose accuracy I could fully rely.†

I will now proceed to lay before the Section a short abstract of the chief results which I have obtained from an unintermitted course of careful experiments on all the urine voided during the past twelve months, some of which will be found of value to future experimenters, though, from causes which I shall describe, they have not realised all my expectations. If, as I had supposed, there had been any known chemical method of determining, with a near approach to accuracy, the amount of uric acid in urine, then the quantities of that acid which Dr. Roberts had found to be removed from calculi out of the body were abundantly sufficient to be ascertained by analysis, on the supposition that the same process went on in the bladder under the treatment recommended by him. I had scarcely, however, commenced my course of experiments before I became convinced of the fallibility of the methods in use for separating uric acid; and the experiments which I have to describe will place that fallibility in a strong point of view.

The method first employed was the ordinary one of adding 5 per cent of hydrochloric acid, allowing the mixture to stand forty-eight hours, and then, after decantation, collecting the uric acid on a small filter, washing it with distilled water, and drying it at 212° F. till it ceased to lose weight. The first seven determinations, from the 20th of August, 1868, to the 26th, inclusive, were made each day on the urine of the preceding twenty-four hours, in a neutral or slightly alkaline state, brought to that state by doses of from 120 to 165 grains of citrate of potash. The quantities of uric acid obtained varied from 11·08 to 8·43 grains. In the subsequent daily determinations, down to the 5th of September, acid reactions were interpolated, due to the use of smaller alkaline doses, which lowered, proportionably, the amount of uric acid obtained; and, when no alkali had been taken for two days, and the urine was, in consequence, strongly acid, the quantity of uric acid found was only 2·35 grains.

From this time commenced a course of large quantities of citrate of potash, amounting, during fourteen days, to 315 grains in twenty-four hours, taken in a state of effervescence, in doses of 45 grains, dissolved in 3 fluid ounces of water. For ten of these days, the hydrochloric acid was used to precipitate the uric acid; and the determination of this gave from 11·95 to 6·00 grains. In every case but the last, the whole urine of the twenty-four hours had been used; but, in the last, half was treated with hydrochloric acid, and the other half with the same proportion of nitric acid: that treated with the former acid gave 6·42 grains, whilst that with the nitric acid gave only 1·97 grains. On the following day, half the urine was treated by Lehmann's process, and gave 6·40 grains; half with nitric acid and acetic acid, in equal proportions, which gave 4·09 grains uric acid. The preference, however, assigned by Dr. Thudichum, in his able and well-known treatise on the "Pathology of the Urine," to nitric over hydrochloric acid as having given him better results led me to continue its use.

The quantity of citrate of potash taken was then raised to 350 grains for four consecutive days. On the first of these days, the uric acid found was 1·54 grains; on the second, 1·23 grains. These results were so extraordinary that, for the purpose of corroborating them, or discovering an error in the analysis, I sent 40 fluid ounces out of 61 fluid ounces voided on the latter day to Dr. Thudicum, who was so good as to furnish me with his analysis of it, containing the weights of sulphuric acid, phosphoric acid, chlorine, potash, urea, and uric acid which he had obtained. The uric acid amounted to no more than 0·775 grains.

This result led to one of two conclusions. Either independently of any question of the solution of the calculus the presence of uric acid in the bladder had been almost entirely prevented by the alkaline treatment, or the process for obtaining it was altogether unreliable. Taking the latter alternative as far the more probable, I endeavoured henceforward to improve the analysis. The mucus secreted from the bladder by the alkaline action being now a good deal in excess, I was advised that it would be prudent to diminish the quantity of alkali taken; and it was accordingly reduced, for five days, to 300 grains of the citrate, and, for eight days, to quantities varying from 270 to 240 grains. The alkalinity was now determined for every voiding with hydrochloric acid. 2·5 per cent of that acid was added to each; and, as it had been observed that uric acid was lost by decantation, however careful, the portions of urine operated upon were entirely filtered, and the water with which the precipitates were washed was acidified with acetic acid. Under this treatment, on the fifth day of taking 300 grains of citrate, the alkalinity, measured by a standard solution of hydrochloric acid, and estimated in grains of carbonate of potash, was 25·5 grains per pint. The uric acid obtained weighed 4·74 grains; and the series below 300 grains of citrate gave quantities of uric acid varying from 2·91 grains, the alkalinity being 23·05 grains per pint, to 8·42 grains, the alkalinity being 17·2 grains per pint.

One-half of that which, with 2·5 per cent hydrochloric

* *Medico-Chirurgical Transactions*, vol. xlviii., p. 89.

† My assistant, Mr. W. P. Horn, learned, in Sir Benjamin Brodie's School of Chemistry, in Oxford, those habits of precision in manipulating and accuracy in observing which are essential to chemical experiments.

acid, had yielded 8·42 grains was treated with 5 per cent nitric acid, and kept at the temperature of 90° F.; and, to render the experiment analogous to Dr. Thudichum's analysis, the alkalinity and dilution were brought to a similar standard by additions of carbonate of potash and water. The uric acid thus obtained weighed 2·07 grains, showing a loss, by this method, of 6·35 grains.

The following table contains an account of the uric acid obtained on the thirty-five days from October 9th to November 12th, inclusive, as well as of the potash taken, and the quantity and alkalinity of the urine.

Citrate of potash.	Alkali, per pint.	Uric acid.	Urine voided, in ounces.
220	16·3	6·9	51·4
20	16·8	5·6	46·6
10	22·1	8·1	40·6
255	4·2	12·2	49·7
240	19·1	7·9	47·1
240	21·3	10·6	50·7
240	30·9	9·3	55·1
225	20·0	8·4	51·9
260	36·2	6·4	46·4
270	19·5	5·5	59·0
230	18·4	6·5	56·5
240	16·8	9·1	60·7
270	22·6	7·1	53·5
270	29·0	6·6	63·5
255	27·5	8·4	59·7
285	35·4	3·23	62·5
255	40·3	7·1	52·0
240	29·4	9·6	52·0
240	19·8	8·8	52·9
225	23·3	8·7	60·3
140	10·0	11·9	64·7
140	5·0	5·1	57·2
120	1·4	4·9	44·0
120	4·2	6·4	45·0
25	5·2	7·8	51·5
185	7·6	8·4	52·5
225	26·3	7·3	51·5
210	17·4	9·7	61·9
210	22·0	7·3	64·5
210	16·4	8·3	76·4
210	19·2	8·5	42·5
210	19·5	9·4	51·4
210	19·8	9·9	63·5
195	21·3	7·6	53·5
180	21·2	11·6	55·5

In this table, the highest quantity of uric acid, 12·2 grains, is connected with an alkalinity of 4·2, while the lowest quantity, 3·2, was obtained when the alkalinity was as high as 35·4. Twenty days, in which the alkalinity of twenty-four hours varied from 19·2 to 40·3, gave an average of 7·94 grains; whilst fifteen days, when the alkalinity was from 19·1 down to 1·4, gave an average of 8·08 grains. These data would lead to the supposition that the alkali had exercised no action on the calculus; but, on the other hand, the great and sudden rise of the uric acid, when the alkalinity descended from 22·1 to 4·2, might raise a suspicion that the alkaline treatment may reduce the secretion of uric acid, and, in that case, the absence of solvent action cannot be inferred.

A good deal of blood passed with the urine from the 13th to the 16th of November, accompanied with some diarrhœa and sickness. On the 17th, the determination of the uric acid was resumed; the alkalinity on that day being 5·3; the uric acid was 11·55 grains. On the following day, the acidity being 10·8, the uric acid was 10·38 grains.

I now instituted some new experiments, on the effect which different degrees of dilution in urine produce on the separation of uric acid. On November 19th, 40 grains of citrate of potash having been taken, the urine voided in twenty-four hours amounted to 31 fluid ounces; it was neutral; the sp. gr. was 1·032. It was divided into three equal portions, one-third in the natural condition treated in the usual manner with 2·5 per cent. Hydrochloric acid gave uric acid at the rate, for twenty-four hours, of 11·78 grains; one-third, diluted with its own bulk of water, and of sp. gr. 1·022, treated in like manner, gave uric acid 10·99 grains; one-third, evaporated down to half its bulk, and then heated with the same quantity of hydrochloric acid, gave, uric acid, 13·81 grains. November 22nd. 180 grains of citrate having been taken, the alkalinity being 1·96, and the sp. gr. 1·030, the urine for the twenty-four hours, amounting to 41·5 fluid ounces, was divided into two portions, one of which, in the natural condition, gave 12·32 grains, the other, concentrated to one third, sp. gr. 1·070, gave 14·78 grains of uric acid. On the 23rd, the same quantity of citrate being taken, the alkalinity, 18·05, sp. gr. 1·028, the quantity of urine, 42 fluid ounces, one-half in the natural condition, gave 12·72; the other half, concentrated to one-fourth, sp. gr. 1·072, gave 14·94 grains of uric acid. On the 24th, the same quantity of citrate being taken, the alkalinity, 20·4, sp. gr. 1·030, the quantity of urine 35 fluid ounces; one-half, in the natural condition, gave 10·318; the other half, concentrated to one-fourth, sp. gr. 1·074, gave 12·135 grains of uric acid. On the 25th, the same quantity of citrate being taken, the alkalinity, 21·2, sp. gr. 1·031, the quantity of urine 43 fluid ounces; one-half, in the natural condition, gave 9·94 grains; the other half, concentrated to one-fourth, sp. gr. 1·075, gave 11·02 grains of uric acid. Again, on the 30th, 135 grains of citrate having been taken, the alkalinity, 37·6, the quantity of urine, 40 fluid ounces; one-half, in the natural condition, gave 8·53; the other half, concentrated to one-third its bulk, gave 12·66 grains of uric acid.

These give very nearly the two extremes of difference in forty comparative experiments, in the last fifteen of which the urine was reduced to a standard volume of 6 or 3 fluid ounces, according as half or quarter of the urine was employed; the average difference in these fifteen was 3·03, and in the former twenty-five, reduced to the proportions above described, 3·09 grains. What was the cause of the variation in the differences does not appear; it occurred equally, whether the urine was acid or considerably alkaline.

It follows, I think, from these experiments, that, to any average quantity of uric acid obtained from an unconcentrated urine, 3 grains may be added; and the last experiment described in this paper makes it probable that the employment of a better method of analysis may increase this augmentation.

I was not satisfied, however, that sufficient accuracy of analysis had yet been obtained, and I have since employed the following process, which promises more perfect results:—A fourth of the urine of twenty-four hours is evaporated to 3 fluid ounces; it is treated with a mixture of hydrochloric acid and alcohol in equal parts, each being 2·5 per cent of the quantity of urine employed; it is allowed to stand for forty-eight hours, drained on a small filter, washed with alcohol (methylated spirit), and then with equal parts of acetic acid and water. The colouring matter and phosphates, &c., are thus removed, and the uric acid is of a light colour and perfectly, though confusedly, crystalline.

The advantage which this method possesses over those heretofore in use is shown in the experiment which follows:—In urine having an acidity of 5 grains per pint, the nitric acid method of Dr. Thudichum gave 1·16 grains of impure uric acid; the ordinary hydrochloric acid method gave 5·53 grains; the method above described gave 9·90 grs. of uric acid. I have found this method equally effective in the treatment of acid urine neutralised by potash, and am inclined to believe that it might be not less applicable to that which contains a greater amount of chloride of potassium.

On the whole, these experiments, though they have failed to realise my expectation of testing, by analysis, the effect of Dr. Roberts's solvent treatment on vesical

calculus, may serve to point out to others the road to success in such an attempt; and if they do so, the labour of a twelvemonth will not have been spent in vain.

There is one prominent chemical fact attending these experiments which remains to be noticed—viz., the greater amount of uric acid obtained before the alkaline treatment commenced, than in the last experiment by the same process, in the proportion of 9·56 to 5·53 grains. A similar diminution has taken place in the mineral acids; whilst from 120 to 150 grains of citrate of potash were required for neutrality in August, 1868, in March and April, 1869, from 30 to 60 grains sufficed for the same purpose. Dr. Thudichum's analysis, in September, 1868, gave—of sulphuric acid, 51·1 grains, of phosphoric, 45·7 grains. The analysis made in my laboratory, in March, 1869, gave—sulphuric acid, 25·9, of phosphoric, 34·2 grains, a difference scarcely to be accounted for without reference to the alkaline treatment undergone in the first three months of the interval.

Though I have been unable to produce any *chemical* evidence in favour of the solvent treatment, a fact observed during the whole course of that treatment, and not afterwards, persuades me that a solvent action was really going on. This fact consisted in a small amount of constant deposit, in which fragmentary particles of uric acid were discerned by the microscope, enveloped in mucus, and bearing, in the opinion of Mr. Wells, as well as my assistant, a close resemblance to the detritus left by the incomplete action of carbonate of potash on fragments of uric acid calculi. I suppose these to have been washed out of the bladder in consequence of a partial solution. That no such solution should have been brought into evidence by the many determinations of uric acid, however imperfect, which I have here described, if it cannot be fully accounted for by that imperfection, may possibly be due to a physiological effect of the alkaline treatment in preventing the formation of uric acid, which may have counterbalanced the excess expected from solution of the calculus. This point, a course of experiments which need not be very long, conducted by a process of analysis reliable within a tenth part of the weight of uric acid obtained, ought hereafter to determine.

My experience of the effect of doses of 300 grains of citrate of potash taken in twenty-four hours has convinced me that no disadvantage to health need be dreaded from such a course. I have not suffered so much from dyspepsia during the last twelvemonth as in many former years. Bleeding from the bladder has, indeed, supervened twice, but without any pain or irritation, and I have had no other symptom of the complaint; and this is the experience of a man of eighty years of age, who has been for some years an invalid.

PS. I have omitted to state that the calculus was judged to be uric from the previous passage of crystals of uric acid. Since the alkaline treatment, the urine has been perfectly clear, free from all deposits. It was never ammoniacal when voided, and contained no albumen.

ON SOME

REACTIONS OF CHLOROSULPHURIC ACID.*

By JAMES DEWAR, F.R.S.E., and GEORGE CRANSTON, Edinburgh.

During the course of several experiments on the action of chlorosulphuric acid on phenol, we have noticed one or two decompositions with simple carbon compounds that may be of some interest. Since Kekulé's researches on the phenol sulpho-acids, chemists are agreed that, in these acids, the radical HSO_3 functions as a monadic group. It was but natural to expect that, if we substituted chlorosulphuric acid for sulphuric acid in forming these compounds, we should arrive at similar bodies, with this difference, that, in the one case, we should eliminate the hydrogen of the group acted on as water, and, in the other, as hydrochloric acid. Now, a critical examination of recent researches in the aromatic derivatives shows that certain groups or elements used as substituting agents tend to approach or separate, thereby producing isomeric compounds: for instance, Korner's celebrated synthesis of resorcine starts from dinitrobenzine, where the relative position of the two NO_2's is maintained throughout the number of complex compounds through which this chemist passed in order to replace the NO_2's by hydroxyls. But, if we examine the intermediate compounds produced, it is evident that, if we could change the conditions or modify the relations of the substituting groups, we might arrive at the same products by direct substitution. Thus the dionitrobenzine produced in the second stage of the fore-mentioned synthesis might be made directly if we could form nitro compounds by some reagent other than nitric acid. The experience we possess at the present time is too meagre to admit of any attempted prediction of what would be the effect of substituting the same radical from different sources.

It was our intention to have investigated one reaction from this point of view, and we chose, for this purpose, an examination of the sulpho acid, or acids that would be produced by the action of chlorosulphuric acid on phenol, as compared with the sulpho acids produced when sulphuric acid is used. We were engaged in this direction when Engelhardt published his interesting paper bearing on this point. We have, however, noticed one or two reactions of this substance that may be acceptable at the present time.

The chlorosulphuric acid used in this investigation was prepared by the direct action of sulphuric acid on hydrochloric acid. We found the reaction to go with great ease and rapidity, the temperature of the sulphuric acid, containing a large percentage of sulphuric anhydride, rising to 120° C. The substance had all the properties ascribed to it by Williamson. In our first experiments, we attempted to prepare the acid by acting on sulphuric acid with pentachloride of phosphorus, as described by Williamson. We found it impossible to free the chlorosulphuric acid completely from oxychloride of phosphorus.

We attempted the formation of Kolbe's trichlormethylsulphurous acid by the action of chlorosulphuric acid on chloroform, expecting $CHCl_3+Cl(HSO_3)=CCl_3(HSO_3)$. We found that, when equivalent quantities of chlorosulphuric acid and chloroform were heated in a sealed tube to 120° C., instead of obtaining Kolbe's acid, we got the decomposition products of this acid—sulphurous acid, hydrochloric acid, and chlorocarbonic acid, thus—$CCl_3(HSO_3)=CCl_2O+HCl+SO_2$. The pressure in the tubes being so enormous, we found them extremely liable to burst. No doubt tetrachloride of carbon would give a similar decomposition, with the difference that SO_2Cl_2 would be produced simultaneously. This reaction is interesting, as Schutzenberger has just shown the formation of phosgene gas by the action of sulphuric anhydride on tetrachloride of carbon.

We have examined, also, the action of chlorosulphuric acid on bisulphide of carbon. When equivalent quantities of chlorosulphuric acid and bisulphide of carbon were heated in a sealed tube to 100° C. for some hours, we found the non-miscible liquids changed into a clear, mobile liquid, from which had deposited large yellow crystals of sulphur. The tubes, when carefully opened, continued to evolve gas until the whole of the mobile liquid disappeared: the liquid was condensed sulphurous acid. The gas was collected over water, when a large quantity was rapidly absorbed. The gas not absorbed after it had stood for some time over water we have carefully examined, and found to have all the properties of oxysulphide of carbon. This reaction is interesting as showing the formation of oxysulphide of carbon by direct

* Read before the British Association, Exeter meeting, Section B.

substitution of sulphur in bisulphide of carbon by oxygen. The reaction is evidently—

$$CSS + Cl(HSO_3) = CSO + HCl + SO_2.$$

Probably the reaction would succeed better by the action of sulphuric anhydride on bisulphide of carbon. In this case, the pressure in the tubes would be greatly diminished by evading the presence of the hydrochloric acid gas. Lautenberg has recently shown the formation of oxysulphide of carbon in many reactions; and this is another instance in which it is produced.

THE PREPARATION OF SESQUICHLORIDE OF CARBON.

By H. BASSETT, Esq.

THE vapour of tetrachloride of carbon is passed moderately slowly through a glass tube about 30 inches long, kept at a moderate red heat. The end of the tube fits into a quilled receiver, provided with a tube to carry off the excess of chlorine. The liquid condensed is dark yellow, from the chlorine held in solution, and consists of sesquichloride of carbon, C_2Cl_6, and the liquid chloride, C_2Cl_4, with unaltered tetrachloride. It also contains a very small quantity of the chloride C_6Cl_6.

On exposing this liquid to a good light, the excess of chlorine is absorbed by the C_2Cl_4. It is then distilled with a thermometer. When the temperature has risen to 150°—160°, the residue in the retort consists almost entirely of C_2Cl_6, retaining the trace of C_6Cl_6 and a little impurity, which gives it rather a dark colour. It is poured out into a dish, when it soon becomes solid, and may be purified by crystallisation, or by distillation with the vapour of water. The distillate under 160° is then saturated with chlorine in a good light, when the whole of the C_2Cl_4 is converted into perfectly white C_2Cl_6, which is easily separated from the unaltered CCl_4 by distillation.

In this manner there would be no difficulty in preparing the sesquichloride in any quantity.

ON A VERY CONVENIENT METHOD OF ASCERTAINING THE CONSTITUTION OF FLAMES.

By M. L. DUFOUR.

M. DUFOUR recommends the following process for demonstrating, for instance, that the flame of a candle is formed of a hollow cone, luminous on the outside only, and dark in the interior. For this purpose it is necessary to cut the flame; the most preferable method of doing this is by means of a sheet of water or air. The arrangement is as follows:—A caoutchouc tube has, at one of its extremities, a gas jet, such as is used for common gas flames; this jet has an almost semicircular slit of 0·4 m.m. in depth. The other end of the tube communicates with a reservoir of water placed at a convenient height. Upon a suitable pressure, the water flows out by the slit in the jet, producing a clear sheet capable of preserving, for a sufficient length of time, an invariable form and size. The slit is placed in such a manner that the sheet presents a horizontal surface; and this will easily cut the flame of a candle, showing a perfect section. The hot gases and carbonaceous particles are carried off by the water. On placing the eye above the hollow cone, the luminous wall, &c., can be distinctly seen. Sections may easily be made near the wick or near the point; nothing hinders observation, which may be prolonged at pleasure, and a lens may be used if desired. A flame of gas may be cut and examined in the same manner, but the current of gas must not be strong enough to traverse the sheet of water. If a current of air be caused to come out of the slit by bellows, an invisible sheet of air is formed which is, also, very convenient for making a section of flame. Close observation is quite possible; for the aërial current prevents the heated gases from reaching the eyes, and a lens may be used, as in the former case. The flame forms a cone, whose luminous walls are extremely thin, and their interior can be plainly seen. A platinum wire may be introduced across the section; and, on being plunged as far as the wick, it will remain unreddened in the dark interior of the cone.

A jet of gas issuing from a circular opening, of from 1 to 2 m.m. in diameter, may also be cut very conveniently by the sheet of air. It will be seen to consist of a cone whose walls are brilliant and extremely thin. Upon bringing the sheet of air close to the aperture whence the gas escapes, the flame will be divided at its base and will reappear a little higher. By this means, the entire length of the luminous cone, its thin walls, and their interior may be examined.

If a jet of gas produced by a fan-tail burner be cut, the luminous fan will be found to consist of two brilliant blades, between which there is a narrow obscure space. The blades are at a greater distance apart, and the dark space is wider towards the end of the fantails; and, by assuming a suitable position, it is easy to see through the section of flame into the dark space which separates the brilliant walls, and at the end of this will be seen the slit by which the gas escapes.

Instead of throwing the sheet of air perpendicularly to the flame, M. Dufour thinks it better to throw it partly on one side, on such a plane as to make a slight angle with the axis of the conical flame, or with the plane of the fan-shaped flame. A lateral suction is then produced by the influence of the current, which draws the flame, and inclines it against the sheet of air, by which it is cut. By placing the sheet of air on a more or less inclined plane, and approaching or removing it from the base of the flame, the section is easily made at points more or less distant from that base.

The method described above may, of course, be applied to any kind of flame. M. Dufour suggests that it might be of service in the chemical analysis of flames. When a flame is cut by a sheet of water, the water draws off the gases of which it is composed. If the section be made with a sheet of air, it will be easy, by placing suction pipes throughout the length, and ending at fixed points in the interior of the cone, to collect the gases whose composition is desired to be ascertained.—*Les Mondes.*

THE ECONOMICAL PURIFICATION OF ZINC CONTAINING IRON.

By W. H. CHANDLER.

IN the galvanising of iron, the article to be galvanised, after being thoroughly cleansed, is dipped into a kettle of molten zinc, which forms an alloy with the iron at the surface of contact, and by repeating the dipping the thickness of the superimposed zinc may be increased at pleasure. In the prosecution of this manufacture, the zinc is held in large iron troughs or kettles, which are rapidly corroded in those portions nearest the fire. An alloy of zinc and iron is formed, to which also the articles, being galvanised, in some degree contribute. This alloy being heavier than the purer zinc, sinks to the bottom, and, from time to time, is removed by perforated ladles.

The composition of the alloy is of course somewhat variable, depending upon the temperature and fluidity of the zinc and the careful straining from the fluid metal.

The two analyses here given were made by the writer a number of years since:—

Zinc	94·27	94·15
Iron	5·46	5·00
Lead	0·27	0·56
Tin	trace	0·29
	100·00	100·00

These samples were taken from a re-melting of a large quantity of the alloy, which is the only practicable method of obtaining a fair, average specimen.

The quantity of this dross or refuse is quite considerable, amounting probably, in the United States, to several hundred tons per annum. Formerly it was sold for use in coarse brass castings, and to some extent it was re-distilled. At one establishment in Boston circular clay retorts, similar to those in use in the gas manufacture, were employed, the molten alloy being introduced through an inverted syphon in the iron mouthpiece and the condensing tube, connected with the reverse end of the retort, dipping in a pot of molten zinc; thus all access of air to the interior of the retort was prevented, and little or no oxidation of the zinc occurred.

Several years since, a small lot of this refuse zinc was received at a metallurgical establishment in Massachusetts, in which the writer was employed as chemist, and, in experimenting upon it, one of the foremen of the establishment originated a method by which the zinc could be obtained quite free from iron. Finally, after re-building his furnaces and in various ways altering and modifying his manipulations, the samples of purified zinc being analysed after each alteration of the process, a good commercial article was obtained containing only one-tenth of one per cent of iron.

The process consists in melting the refuse in an iron kettle, raising the heat nearly to the point of volatilisation of the zinc, and then, by a proper regulation of the heat, cooling the mass slowly from the bottom, by means of a special arrangement of flues. An alloy of zinc and iron, containing a much larger percentage of iron than the original refuse, gradually forms, falls to the bottom of the kettle, and is removed by a perforated ladle, while the fluid metal is much purer. The quantity of alloy to be ladled out depends upon the impurity of the original refuse. The purified zinc and the concentrated impurity are melted in separate kettles, and each treated as in the first operation.

One more fusion and refrigeration of the purified zinc and the still more impure zinc, render the former a good commercial spelter and the latter too impure for further economic treatment.

This process is the reverse in its reactions from Pattison's process for desilverising silver-lead ores. In the latter case the purer lead crystallises from the more fluid lead and silver, whereas in the former, the more impure alloy separates from the purified zinc.

The residue from this process, which is sold for distillation, consists of hexagonal prismatic crystals of a fixed alloy of iron and zinc, loosely agglomerated together so as to crumble in the hand.

When the operation of refining is badly conducted, more or less zinc acts as a solder for the crystals. They are beautifully iridescent, exhibiting all the colours of the rainbow, owing to a surface oxidation. A number of specimens of various colours were selected for analysis and showed a composition of—

Zinc	90·50
Iron	9·50
	100·00

Upon fusing these crystals, which requires a high temperature, and cooling as before, a small percentage of purified zinc is obtained, and an alloy containing as much as 12½ per cent of iron. This is compact, somewhat brittle, and exhibits no evidences of crystallisation.

This last-mentioned fusion is not made in practice, as the great heat required for its accomplishment rapidly burns out the iron kettles.

By a similar process lead has been removed from zinc with great accuracy, the amount obtained closely approaching the quantity therein. From a lot of Silesian spelter was separated lead perfectly malleable, and containing scarcely a trace of zinc. The purification of the lead, obtained from the process of desilverisation of silver-lead by means of zinc, could undoubtedly be accomplished by a modification of this process.

NOTICES OF BOOKS.

On Fresh Meat Preservation. By John Gamgee. London: Robert Hardwicke. 1869.

We have, in a pamphlet bearing the above title, an address delivered by Mr. Gamgee before the Board of Agriculture of Amherst (Massachusetts), on a mode of preserving meats for an indefinite time. After many trials, the process which was found to act best was the exhaustion of air from the vessel containing the meat to be preserved, and the introduction of various vapours. Among other substances, the following were tried:—Ozone, chloroform, ether, tetrachloride of carbon, bichloride of methylene, carbolic acid, chlorine, hydrochloric acid, and binoxide of nitrogen; but these were ultimately abandoned for sulphurous acid, introduced into the preserving vessel condensed in the pores of charcoal. "I believe," writes Mr. Gamgee, "that charcoal, saturated with sixty-five times its volume of sulphurous acid, will remain, to the end of days, the cheapest, most manageable, and most universally employed antiseptic that the meat preserver can use. It is, perhaps, bold to predict, that which I do with the greatest confidence, that charcoal and sulphurous acid will, in a few years' time, to a great extent, supersede the use of salt." For various reasons, however, sulphurous acid could not be used alone; and the experiments of Hoppe Seyler suggested the simultaneous employment of carbonic oxide, as it was found to preserve the colour of the meat and to expel the oxygen from the tissues; it also acted as a neutral gas to surround the meat in air-tight vessels in place of atmospheric air. The meat to be preserved was placed in a vessel capable of being exhausted by an air-pump; lumps of charcoal saturated with sulphurous acid were then added, and the vessel was exhausted as completely as possible; carbonic oxide was then introduced until the normal atmospheric pressure prevailed within the preserving vessel. Meat thus preserved was found to keep perfectly, not alone in closed cans, but in open vessels, and it could not be distinguished, as regards taste, from recently killed meat. Of course the chief obstacle to the adoption of the process is the expensive nature of the apparatus, and attempts have been made to displace the oxygen from the neighbourhood of the meat, by driving carbonic acid through the preserving vessel by means of a fan; it is obvious, however, that the tissues would still remain charged with oxygen. Whatever may be the value of this process on the large scale, there can be no doubt that few inventions could, at the present time, be of greater value to the human race at large than one which would secure the utilisation, as food, of the thousands of tons of meat which are now wasted in Australia and Texas, and the Argentine Republic. To allow myriads of oxen to attain maturity, and to destroy them for the sake of their skins alone, seems an act comparable to that of the Roman Emperor who caused several hundred flamingoes to be destroyed that he might be provided with a dish of their tongues.

Cleveland and its Metropolis. September 21st, 1869. Middlesborough-on-Tees: Printed at the *Gazette* Steam Printing Works. 1869.

We have received this neat little pamphlet accompanied by a very good map of the district. Its pages contain a very large amount of diversified information, written and compiled with care, and published especially for the information of those members of the Steel and Iron Institute, who, on the occasion of their first provincial meeting at Middlesborough, repair thither and are strangers to the district. We have an historical and archæological review of Cleveland, next a brief but very comprehensive account of the geology of this part of the county of York, followed by a brief history and description of the municipal and parliamentary borough of Middlesborough. The last two pages are devoted to the quotation of analyses of ironstone of this district, coke, best Durham, Weardale limestone, Forcett limestone, pig-iron, No 1, Acklam ironworks, and an analysis of grey-coloured slag. The authors of these analyses are Messrs. Crossley and Pattinson. At the end of the work a short description is given of the Acklam Ironworks, owned by Messrs. Stevenson, Jaques, and Co. The map which has been sent along with this pamphlet has been published by Messrs. Gillan, Schmitz, and Co., iron merchant and shipowners, Middlesborough and Glasgow, is excellently executed, and deserves creditable notice, especially since this kind of very useful publications, showing as it does the blast furnaces, rolling mills, &c., is too much neglected in this country. Maps indicating the different local industries of a county are very useful, and the getting up and publishing of them deserve every encouragement.

MISCELLANEOUS.

Method of Producing upon Iron a Durable Black Shining Varnish.—M. Weiszkopf.—Take oil of turpentine, add to it, drop by drop and while stirring, strong sulphuric acid, until a syrupy precipitate is quite formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed with water, every time refreshed after a good stirring, until the water does not exhibit any more acid reaction on being tested with blue litmus paper. The precipitate is next brought upon a cloth filter, and, after all the water has run off, the syrupy mass is fit for use. This thickish magma is painted over the iron with a brush; if it happens to be too stiff, it is previously diluted with some oil of turpentine. Immediately after the iron has been so painted, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed over with a piece of woollen stuff dipped in, and moistened with, linseed oil. According to the author, this varnish is not a simple covering of the surface, but it is chemically combined with the metal, and does not, therefore, wear off or peel off, as other paints and varnishes do, from iron.

Oxidation of Ammonia.—Chemists are acquainted with the experiment for showing the oxidation of ammonia, in which a red-hot spiral of platinum wire is introduced into a bottle containing a thin layer of strong ammonia on the bottom; white fumes appear of nitrite and nitrate of ammonia. This experiment may be made far more conspicuous in the following manner:—Take a piece of combustion tube, about 40 or 50 centims. in length; place in the middle thereof a layer of 4 or 5 centims. of platinised asbestos. At one of the open ends of the tube a rolled-up piece of blue, and at the other end a similar piece of red, litmus-paper is placed; the last-named open end of the tube is connected, by means of properly arranged tubing, with a flask containing liquid ammonia; the other open end of the tube, where the blue-coloured litmus-paper is placed, is similarly connected with a flask filled with air. The platinised asbestos is next heated to redness, and kept in that state by suitable means. By the employment of a properly arranged tube, a current of air is slowly blown through the flask containing ammonia; when this is continued for a few moments the red litmus-paper will be observed to become blue, and the blue litmus-paper, at the other open end of the tube, will be seen to become red, whilst, at the same time, there will be deposited at the colder portions inside the tube, behind the red-hot platinised asbestos, a broad white ring of nitrite and nitrate of ammonia, while red vapours begin to fill the empty flask. When the gas, after having passed over the platinised asbestos, is made to come into contact with a strong solution of protosulphate of iron, to which some few drops of sulphuric acid have been added, this solution soon becomes deep blackish brown. A solution of iodide of potassium, to which a clear starch paste has been added, is, on being brought into contact with this gas, instantaneously coloured blue; while a strong solution of indigo in concentrated sulphuric acid, after having been gently heated, is very rapidly decolourised on coming into contact with this gas.—*Berichte der Deutschen Chemischen Gesellschaft zu Berlin.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, September 27, 1869.

This number, an unusually thin one, opens with a brief, but very touching speech of M. Dumas, announcing the demise of the late Master of the British Mint, who was a corresponding member of this institution. The eminent speaker dwelt for a few moments on the great scientific merits of the deceased, pointing out his discoveries and researches, and expressing regret at the loss of such an eminently distinguished *savant*.

The following are the original papers and memoirs relating to chemistry contained in this number:—

Action of Permanganate of Potassa upon Asparagine.—M. Campani.—Asparagine is converted, by the action of water alone, into aspartate of ammonia. According to this author, asparagine is converted, by the oxidising action of permanganate of potassa, into ammonia, oxalic acid, carbonic acid, and a trace of hydrocyanic acid.

The Vacuum as a means of Preventing Explosions in Coal-Pits.—M. Raffard proposes that, on Saturday evenings, all the shafts of a coal-pit, one only excepted, shall be hermetically closed, and that that shaft shall be put into communication with an air pump, which, on withdrawing the air, will cause the marsh gas, fire-damp, freely to issue from the pores of the coals, and thereby cause a thorough cleansing of the air of the pit. It is very difficult to imagine that such a proceeding will have any really useful effect.

New Hygrometer.—M. Crestin.—The author proposes to place, on the plate of an areometer, a quantity of perfectly dry common salt; the areometer is then placed in pure water, which is covered by a layer of oil. While the salt absorbs moisture, the areometer gradually sinking into the water indicates the degree thereof.

Chinese Industry.—M. Champion.—The author has published a work on the ancient and modern industries of the Chinese Empire. This work is highly spoken of by M. Dumas, who points out that the Chinese excel Europeans in many matters.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 13, 1869.

From the proceedings of the meeting of this Society, held under the presidency of Dr. A. W. Hofmann, on the 12th of July last, and recorded in this number, we find, among the foreign gentlemen elected members of this Society, the names of Prof. Abel, of Woolwich; Dr. E. H. Kinson, Sandhurst, Farnborough; and Dr. W. Odling. The following papers and communications were read:—

Constitution of Tourmalin.—M. C. Rammelsberg.—In the introduction to this essay, the author points out the difficulties which beset this subject, which has frequently been worked at by various mineralogical chemists; but, notwithstanding the author himself made a large number of analyses of this mineral, several points of interest were not clearly elucidated, among these—(1) The behaviour of tourmalin on ignition; (2) the degree of oxidation of iron, forasmuch as this metal occurs in this mineral, which is not the case with all varieties thereof; (3) the precise quantity of boron contained in tourmalin. Tourmalin is a very complex mineral; it contains the following elements:—H, K, Na, Li, Fl, Mg, Ca, Mn, Fe, O, Si, B, and Al. Tourmalines are found not containing Li, Fe, Mn, or Ca. The colourless, or pale red-coloured tourmalin, from Elba, contains 0·2 per cent of MgO; a brown variety, from Windischkappel, contains 11·8 per cent MgO; the black tourmalin, from Andreasberg, contains 17·4 per cent FeO. Magnesia tourmalines are yellow or brown-coloured; the magnesia-iron tourmalines are dark brown or black-coloured; iron tourmalines are quite black-coloured; and the tourmalines which do not contain any iron at all but manganese, are rose or pink-coloured, or sometimes even colourless. As regards the fundamental composition of this mineral, it is a tri-silicate—

$$\overset{I}{R_6}SiO_6—\overset{II}{R_2}SiO_3—\overset{VI}{R}SiO_3.$$

The author proceeds at length, enumerating the various species of this mineral, according to the prevalence therein of certain elements; but, strictly speaking, this portion of his paper rather belongs to

mineralogy, and our space, moreover, forbids us to quote the large number of formulæ required to elucidate this subject.

On Chloral.—MM. Martius and Mendelssohn-Bartholdy.—The authors state that they have been induced to try whether it would not be possible to prepare chloral in large quantities, so that if this substance should become used in pharmacy, it could be obtained in a pure state. The hydrate of chloral would, according to the authors, answer this purpose by far the best. This hydrate ought to be a white crystalline mass, endowed with considerable hardness; it should dissolve readily in water, and be devoid of any smell of chloride of carbon or hydrochloric acid, while it should exhibit its peculiarly strong smell. The authors exhibited at this meeting several pounds' weight of chloral, and stated that they hope shortly to be able to exhibit to the members of this Society the synthesis of chloroform by an easily executed method, as also trichloracetic acid, made according to M. Liebreich's method.

On Euxanthon.—M. A. Baeyer.—According to the researches of the late Prof. Gerhardt, the euxanthon, obtained by M. Erdmann from the euxanthinic acid contained in Purrhee, should be composed according to the formula $C_{10}H_8O_3$. The author found that, when vapours of euxanthon are passed over powder of zinc heated in a combustion tube, there is formed a semi-solid hydrocarbon, resembling diphenol; and he concludes, hence, that euxanthon is not a derivative from naphthaline, but has to be referred to a benzol containing four atoms of carbon in a peculiar form. The author, on treating euxanthon with bichromate of potassa and sulphuric acid, did not succeed in obtaining products of oxidation of euxanthon, since the reaction became too violent; but, on fusing euxanthon with caustic potassa, a new substance was obtained, which the author calls euxanthonic acid, $C_{13}H_{10}O_5$. It is a weak acid, which yields, with basic acetate of lead, a reddish yellow-coloured precipitate; with chloride of iron, it yields a red colouration; euxanthon, on the contrary, yields, with that reagent, a green colouration. Euxanthonic acid is far more readily soluble in water than euxanthon.

Synthesis of Picolin.—M. Baeyer.—When acrolein-ammonia is submitted to distillation, an aqueous ammoniacal fluid and a basic oil are obtained. M. Claus discovered that the double salt of platinum of that base possesses the same composition as the picolin platinum salt, $NC_6H_7Cl.PtCl_2$; but the properties of that salt do not at all remind one of picolin. The author of this paper found that the aqueous ammoniacal fluid, which has not been investigated by M. Claus, contains a large quantity of picolin, and this picolin exhibits the very identical properties possessed by the picolin obtained from coal-tar and bone distiller's tar. The author explains the origin of picolin in the following manner:—Fatty substances yield acrolein, and, under the joint influences of ammonia and a high temperature, picolin is formed, according to the following formula:—

$$2C_3H_4O + NH_3 = NC_6H_7 + 2H_2O.$$

Derivatives from Naphthaline.—MM. Darmstädter and Wichelhaus.—The authors continue in this paper the communication of the results of their experiments on this subject, and describe, at great length, how they succeeded, by a very complex process, in obtaining bicyanaphthaline—

$$C_{10}H_6\begin{Bmatrix}CN\\CN\end{Bmatrix}$$

This substance exhibits needle-shaped pale yellow crystals, difficultly soluble in alcohol and ether, insoluble in water, and fusing at 204°. From this substance, the authors have prepared a compound which they call bicarbonaphthalinic acid—

$$C_{10}H_6\begin{Bmatrix}CO.OH\\CO.OH\end{Bmatrix}$$

This substance is a solid crystalline material, very difficultly soluble in boiling water, soluble in alcohol, not fusible nor decomposed at 240°. The authors refer, in this paper, to three varieties of bicyanaphthaline, in addition to the substance of that name already alluded to, and each obtained from a different naphthaline compound.

Action of Fusing Hydrate of Potassa upon Stearolic Acid.—M. S. Marasse.—The author, after referring to the labours of Messrs. Frankland, Duppa, Overbeck, and others, on this subject, states that stearolic acid is not a substituted acrylen, but that the molecule of this acid contains twice the group C=C. Acting upon this idea, the author has succeeded in so managing the action of the fusion with hydrate of potassa as to obtain from stearolic acid a homologue of acrylic acid. The new acid thus obtained is a colourless fatty matter fusing at 21°; its formula is $C_{16}H_{30}O_2$.

Constitution of Benzol.—M. A. Kekulé.—Unless we reproduce the woodcuts annexed to this paper, and essential to its proper elucidation, we cannot usefully give an abstract of it.

Crotonaldehyde.—M. A. Kekulé.—This paper contains the results of a series of experiments, made with the view to prove, experimentally, the mode of the combination of the atoms of carbon in benzol. The paper is too lengthy, and so crowded with formulæ, that it is impossible to give a proper abstract of it.

Lecture Experiments.—M. Kessler.—No. 1. Ignition of a mixture of H and Cl by means of the flame of CS_2 burning in NO, is rather awkward to manage. The author uses the magnesium light for that purpose. After having fastened a bottle filled with H and Cl to a retort stand, a piece of magnesium ribbon is taken hold of with a pair of forceps, ignited in the flame of a spirit-lamp, and moved, close to the bottle, up and downwards. A slight shock indicates the end of the reaction. The bottle is next opened under water.—No. 2. When burning magnesium wire is placed in a vessel containing CO_2, the latter is decomposed, and carbon deposited. Some HNO_3 should be poured into the vessel at the end of the reaction, in order to dissolve some magnesia resulting from the combustion, and to make the deposit of C distinct.—No. 3. Water having been poured in a rather wide-mouthed flask, it is made to boil as briskly as possible. When, after this boiling has been continued for some time, previously-ignited magnesium wire is held deep down in the mouth of the flask, it continues to burn. The same metal burns with great brilliancy in N_2O and NO, also in H_2S and SO_2, but is extinguished by CO. The floating of soap bubbles upon CO_2 is exhibited with the least expenditure of that gas when it is made to pass through the narrow neck of a large glass funnel.

On Diazocyanbenzol.—M. P. Griess.—This paper contains a first instalment of the results obtained when experimenting on the products of decomposition of diazocyanbenzol. Among these, the author found diazocyanbenzolimid—

$$[C_6H_3(CN)N_2]''\Big\}N + 3NHBr.$$

This substance is a solid body, almost insoluble in water; readily soluble in warm alcohol; crystallising, from the solution in that fluid, in large needle-shaped bright yellow-coloured crystals; fusing at 57°, and exploding when more strongly heated. Iodinecyanbenzol, also a solid substance, insoluble in water, readily soluble in alcohol and ether, and fusing at 41°.

Some Derivatives from Anethol.—M. Ladenburg.—After referring to his former researches on this subject, the author states that he has succeeded in obtaining anol, a solid substance fusing at 92·5°; soluble in alcohol, ether, and chloroform; and boiling at 250°. Formula, $C_9H_{10}O$. Chloranethol is a somewhat yellowish-coloured fluid which solidifies at a low temperature, and becomes fluid at −6°; boils at 257°; sp. gr., 1·1154. When this body is treated with caustic potassa, and heat applied, there is formed a substance, $C_{10}H_{10}O$; it is a liquid insoluble in water, and boiling at about 242°.

Chrysophanic Acid.—M. Rochleder.—When this acid is distilled along with powdered zinc, anthracen is formed. After this statement, the author proceeds to discuss the formula which chrysophanic acid ought to have, and, having found that chrysophanic acid, dried at 100° (all analyses made of this substance have been made with quantities thereof which were dried at that temperature), retains water, which can only be expelled at 115°, aided by a current of dry carbonic acid gas. The author ascribes to this circumstance the discrepance of the results of the elementary analyses made of this substance, and suggests that the formula of the acid dried at 100° should be written $4(C_{14}H_{10}O_4)+OH_2$. The author also found that chrysophanic acid made from rhubarb root is always contaminated with emodin; but this substance being soluble in a hot solution of carbonate of soda, wherein chrysophanic acid is insoluble, the two may be separated from each other in that manner. Emodin may be precipitated by acids from its alkaline solution, and, after having been carefully washed with water, may be dissolved in alcohol 80 per cent, and obtained in crystals on evaporation of that solution. Emodin exhibits an orange-yellow colour. The chrysophanic acid which has been separated, as described, from emodin, should first be well washed with water, and next repeatedly treated with boiling alcohol of 90 per cent, and thus obtained in pure state. So purified, the formula for dry chrysophanic acid is $C_{14}H_{10}O_4$.

On Naphthaline Red.—Dr. A. W. Hofmann.—At the Paris Exhibition of 1867, there was only one naphthalin colour exhibited, to wit, the naphthaline yellow (dinitro-naphthol) discovered by Dr. Martius. The author says that he has received, from his friend M. Scheurer-Kestner, a quantity of a very remarkable substance, now known as naphthaline red on the continent, and in England designated Magdala red. This substance, as sent to Dr. Hofmann, exhibits a blackish brown, somewhat crystalline, powder, soluble in alcohol, yielding a deeply red-coloured solution, on evaporation of which greenish crystals endowed with metallic lustre are obtained; these crystals proved to be the chloride of a base which, on analysis, was found to be composed of $C_{30}H_{21}N_3$. The eminent author proposes to investigate this subject more fully, for which reason the brief account here given may suffice for the present, the more so as the manufacture of this naphthaline red (first made at Büsle, on the large scale) is as yet rather uncertain.

On Xylidine Red.—Dr. A. W. Hofmann.—When pure xylidine is treated with oxidising agents, no red-coloured pigment is obtained; neither is this the case when, after having been mixed with toluidine, xylidine is treated as is done for the preparation of rosaniline; but when xylidine is mixed with aniline, and then treated with the agents used to make rosaniline, a most beautiful carmine red pigment is obtained which dyes wool and silk a very fine colour. The probable composition of this pigment is $C_{28}H_{23}N_3,H_2O$.

Contribution to our Knowledge of Chrysaniline.—A. W. Hofmann.—When a solution of pure chrysaniline in pure wood-spirit (methyl-alcohol) is mixed with iodide of methyl, and heated in a sealed tube, for about six hours, to 100°, a solid crystalline substance is obtained, which, after having been purified, may be dissolved in boiling water, from which solution beautifully orange-carmine red crystals are deposited, which constitute the diiodhydrate of trimethyl-chrysaniline, $C_{30}H_{14}(CH_3)_3N_3,2HI$; the solution of this salt dyes wool and silk a deep orange-yellow, verging upon scarlet-red. From this substance, on being treated, when in solution, with ammonia, the monoiodhydrate of trimethyl-chrysaniline is obtained—

$$C_{30}H_{14}(CH_3)_3N_3,HI.$$

Trimethyl-chrysaniline yields, with acids, very well-defined salts, which are rather readily soluble in water, excepting the nitrate and picrate. Chrysaniline behaves with iodide of ethyl as it does with iodide of methyl.

Porphyritic Rocks of Austria.—M. G. Tschermak.—The Vienna correspondent of this Society, M. Ludwig, writes to the effect

that the author named at the heading of this paragraph has made a series of researches on augite and amphibole. The former mineral, if crystallised, is a combination of $MgCaSi_2O_6$ and the therewith isomorphous $FeCaSi_2O_6$. Augite, which is imbedded in rocks, contains alumina, and, moreover, a silicate made up according to the formula, $MgAl_2SiO_4$. The composition of amphibole is rather more complex, because it also contains a soda silicate.

On Benzylic Acid.—M. A. Jena.—When benzile is heated with an alcoholic solution of caustic potassa, benzylic acid is formed, and also benzoic acid. Benzylic acid is formed more readily when benzile is heated with water in sealed tubes. Pure benzylic acid fuses at 150°; moistened with concentrated sulphuric, it becomes red-coloured; heated for some length of time to 180°, it yields a red-coloured resin, and a compound, $C_{28}H_{32}O_8$. When benzylic acid is treated with dilute sulphuric acid and bichromate of potassa, water, carbonic acid, and benzophenon are formed—

$$\underbrace{C_{14}H_{12}O_3}_{\text{Benzylic acid.}} + O = H_2O + CO_2 + C_{13}H_{10}O.$$

Formation of Adipinic Acid from Mucic Acid.—M. L. Marquardt.—The author says—"Some time ago M. Bode succeeded in obtaining from the compound $C_6H_4Cl_2O_4$ (which compound is the result of the action of excess of phosphor-chloride upon mucic acid), by means of zinc or sodium-amalgam, a substance which he (M. Bode) called muconic acid, $C_6H_6O_4$; this acid only differs from adipinic acid by a deficiency of 2H. The author of this paper states that he has obtained, from muconic acid, pure adipinic acid, by treating the former, after having been moistened with water, with sodium-amalgam, and leaving this mixture standing for some hours in a warm place. The fluid, after having been removed from the mercury, is acidified with dilute SO_3, next shaken up with ether, and, on removal of that fluid, by distillation, adipinic acid remains behind.

Annalen der Chemie und Pharmacie, September, 1869.

This number opens with a series of three treatises on trimethyl benzol. The first of these papers treats on—

The Trimethylbenzol which is Formed by the Introduction of an Atom of Methyl into Xylol.—MM. R. Fittig and K. Laubinger.—In the introduction to this paper, the authors state that mesitylen is a peculiarly-modified trimethyl-benzol; and that the substance which, under the name of cumol, or pseudo-cumol, has been met with in coal-tar is also a modification of trimethyl-benzol, but different from mesitylen by its monobromide, $C_9H_{11}Br$, which is a crystalline substance, fusing at 73°. Pseudo-cumol has often been the subject of chemical researches; but the authors of this paper deny any value to these researches, since, according to them, pseudo-cumol, as applied to these researches and obtained from coal-tar, is and always remains, any rectifications and fractional distillations notwithstanding, a mixture of several hydrocarbons. The authors, therefore, have prepared pseudo-cumol synthetically, by introducing into xylol 1 atom of methyl. The fluid thus obtained was purified by distillation with sodium, and was found to boil constantly at 166°. *Products of substitution of pseudocumol.*—Mononitropseudocumol, $C_9H_{11}(NO_2)$, is a solid substance, crystallising in prisms, fusing at 71°, soluble in alcohol. It is distinguished from nitro-mesitylen by its point of fusion, and by its being soluble in cold fuming nitric acid without thereby undergoing any change. Dinitropseudocumol has not been obtained by the authors in pure state. Trinitropseudocumol, $C_9H_9(NO_2)_3$; also a solid substance fusing at 185°, and crystallising from its solution in benzol in large quadratic-shaped prisms. The authors then treat, under the following heads, the following subjects:—*Products of reduction from trinitropseudocumol; bromated products of substitution from pseudocumol; products of oxidation of pseudocumol.* Among the latter, xylylic acid, $C_9H_{10}O_3$, is found; also paraxylylic acid, and xylydinic acid, $C_8H_6O_4$, which are described at great length, as well as their salts.

The second treatise on this subject is headed—

On the Trimethylbenzol which is Generated when Two Atoms of Methyl are successively introduced into Toluol.—MM. Fittig and Jannasch.—The authors say they have proved, by researches made and published some time ago, that the methyltoluol prepared sythetically from toluol differs from xylol; a difference undoubtedly due to the unequal position of the atoms of methyl towards each other. The authors therefore argue that, if, synthetically, a third atom of methyl be added to the methyltoluol (dimethylbenzol), a trimethylbenzol, different from pseudocumol, will be obtained. In order to prove this hypothesis by experiment, they prepared from toluol a large quantity of methyltoluol; and, on treating that with bromine, obtained *monobromated methyltoluol*, $C_6H_3Br(CH_3)_2$, a liquid as clear and colourless as pure water, boiling at about from 204° to 206°. By means of iodide of methyl and sodium, trimethylbenzol was prepared from the liquid just alluded to. The result was the generation of a liquid boiling at 166°, and not differing in physical qualities from pseudocumol. In many of its chemical characters, this trimethylbenzol is not distinguished from pseudocumol. The greater part of this paper is devoted to a discussion of the relative position of atoms of CH towards other groups of polymers thereof; but since, without the introduction of some woodcuts annexed to the original, this rather abstruse subject cannot be clearly understood, we proceed to the third treatise:—

On the Trimethylbenzol contained in Coal-Tar.—MM. Fittig and Wackenroder.—The authors have prepared from the hydrocarbons of coal-tar (which have a high boiling point), by carefully-conducted, often-repeated, fractioned distillation, a hydrocarbon, the boiling point of which lay between 164° and 167°. This material has been converted into a trinitro-compound, which, after having been purified, yielded a solid crystalline body, fusing at 230°, soluble in alcohol, and yielding, after carefully-conducted elementary organic analysis, results leading to the formula $C_9H_9(NO_2)_3$. On dissolving this substance in warm benzol, the authors found that the body alluded to is not a simple compound, since the mother liquor of the solution in benzol yielded, on evaporation (after the previous separation of the crystalline compound just mentioned), a batch of prismatically-shaped crystals, entirely different from the needle-shaped body first obtained, which last crystalline body was found to fuse at 185°, and to possess all the properties of trinitropseudocumol. The researches of the authors, very exhaustively described, lead to the result that the trinitro-compound obtained from the hydrocarbon from coal-tar above alluded to is a mixture of trinitromesitylen and trinitropseudocumol; accordingly the hydrocarbon from coal-tar boiling at from 164° to 167° is a mixture of pseudocumol and mesitylen, which latter substance may even be prevalent in this fluid.

Electrolysis of Water in Contact with Silver.—Dr. Runspaden.—This monograph treats on the fact first observed by Prof. Wöhler—that when water acidified with sulphuric acid is decomposed by a galvanic current, and silver is applied as electrodes, peroxide of silver is deposited on the anode and metallic silver on the cathode. The two main questions answered by the author by a series of experiments are—What is the cause of the formation of peroxide of silver on the positive pole, and by what means does the metallic silver find its way from the positive to the negative pole? The treatise is too lengthy and too concisely abstracted already in this periodical [the treatise was published originally as a separate work] to admit of useful condensation. In an appendix, the author informs us that there is an error in all works treating on chemistry and physics, viz., the statement that gold (pure, of course) and platinum are the only two metals which are not oxidised at the positive pole when serving as electrodes. The author finds, and has confirmed by experiments carefully conducted, so as to exclude any source of error, that gold itself is oxidised to a very considerable extent, and that, during experiments as those alluded to, there is formed a definite oxide, $Au_2O_3,3H_2O$; percentically—gold, 79·47; oxygen, 9·62; water, 10·91.

On Chlorous Acid.—M. Brandau.—The author gives, in about twenty pages, a very complete and exhaustive treatise on the preparation and properties of chlorous acid, both as gas and as liquid. Since, however, the engravings added to this paper are absolutely required to understand a great part of it, we content ourselves by describing the properties of the liquid chlorous acid. It is a liquefied gas; colour of fluid, deep red-brown; very fluid. Even below 0°, the vapour of this liquid exerts a considerable pressure. Freshly prepared, the fluid boils about half a degree above 0°. If this fluid is suddenly brought to a temperature of about + 8° to 10°, it explodes with great violence. It cannot be kept without continuous and spontaneous decomposition for any length of time. The gas given off from this liquid exhibits the well-known greenish-yellow colour of chlorous acid. The specific gravity of the liquefied gas at 0°, referred to water at 4° (the point of greatest density of water), is 1·3298.

Preparation of Chlorate of Baryta.—M. Brandau.—The author makes a mixture of commercial sulphate of alumina, of sulphuric acid, water, and chlorate of potassa. The mixture should have the consistency of a thin magma, and be heated on a water-bath during half an hour, while it is frequently stirred up. The reaction which takes place is represented by the undermentioned formula:—

$$[Al_2(SO_4)_3] + SH_2O_4 + (ClKaO_3)_2 = [Al_2(SO_4)_3 + SKa_2O_4] + (ClHO_3)_2.$$

The product is a solution of hydrated chloric acid, alum, excess of sulphate of alumina, and excess of sulphuric acid. After the mixture has become quite cold, it is mixed with several times its bulk of alcohol, filtered, and washed with alcohol of 50 per cent. The alcoholic filtrate is neutralised with hydrate of baryta, whereby chlorate of baryta, sulphate of baryta, and some alumina are formed. The bulk of the alcohol is removed by evaporation. The aqueous solution of chlorate of baryta is next filtered, and the residue washed with water (distilled, of course). The liquid is next evaporated to crystallisation, yielding pure chlorate of baryta. A slight excess of sulphate of alumina and sulphuric acid should be applied, since, otherwise, some chlorate of potassa will remain mixed up with the chlorate of baryta.

The Brominated Products of Substitution of Dibenzyl.—Dr. Marquardt.—The author first refers to the researches made on this very same subject by MM. Fittig and Stelling, and then describes a series of identical compounds as those obtained by the parties just named, but prepared in a different manner. Chiefly the effect of a different temperature appears to be in play, in this instance, to produce compounds of different physical properties.

On some Products of Decomposition of Tribenzylamine.—M. W. Rohde.—This paper, being a critical review of M. Limpricht's labours on this subject, is not well suited for abstraction.

Determination of the Equivalent of Albumen.—M. Fuchs.—After briefly reviewing the researches made by Messrs. Schwarzenbach, Lieberkuhn, and others, on this subject, the author describes a series of his own experiments, the main result of which is that the precipitates formed by albuminous substances and platino-cyanide of potassium are substances of variable composition and decomposable by water. The author also found that the silver compound of albumen applied by M. Lieberkuhn for the determination of the albumen does not answer that purpose, since, on repeating, even up to seven times, the last-named author's experiments, he found the results to vary considerably, and, among themselves, to be different from those obtained by M. Lieberkuhn. On repeating M. Commaille's experiments on this subject, the author found that his very carefully-conducted experiments agreed with those of the last-named gentleman

very closely, and that, therefore, the compound obtained when chloride of platinum and a slightly acidified solution of albumen are mixed is the precipitate best suited for the determination of the equivalent of albumen.

Occurrence of Laurite in the Platinum Ore found in the Oregon Territory, U.S.—Prof. Wöhler.—Laurite is a mineral, first met with in the platinum ores found in Borneo, and composed of sulphide of ruthenium and sulphide of osmium. In the platinum ore here alluded to, this mineral is met with in such minute crystals that they are only distinguishable when magnified 50 diameters. Chemical tests, however, distinctly detected the laurite, which has been fully described some years ago by this eminent author.

Zeitschrift für Chemie von Beilstein, No. 15, 1869.

This number contains the following original papers:—

On Orthonitrodichlorophenol and an Isomeric Dichlorophenol.—M. O. Seifart.—Orthonitrodichlorophenol, $C_6H_2Cl_2NO_3OH$, is a solid substance, crystallising, from its ethereal solution, in rhombic-shaped crystals; soluble in ether, alcohol, and chloroform, but not in water; is not capable of being sublimed; fuses at 125°, but becomes decomposed at the same time. The author gives a catalogue of salts which this substance forms:—The ammonium salt, $C_6H_2Cl_2NO_3ONH_4+HO$, is a crystalline substance, readily soluble in hot water; orthoamidodichlorophenol is a solid substance, soluble in water, but far more readily in alcohol, and fuses at 166°; dichlorphenol, $C_6H_3Cl_2OH$, is a solid substance, difficultly soluble in water, readily soluble in alcohol and ether, fuses at 65°, and boils at 220°.

On Chloronitrophenols.—MM. Faust and Saame.—Chloronitrophenol, $C_6H_4Cl(NO_2)O$, is a solid body, exhibiting bright yellow-coloured, large sized crystals; it smells like saffron, fuses at 87°, is nearly insoluble in water, but readily soluble in alcohol and ether; it forms salts which crystallise, and are readily soluble in warm water. The authors give a lengthy catalogue (the name and formulæ) of a series of these salts, and distinguish α, β, and otherwise designated compounds, which, however, vary only in slight particulars from each other.

Decomposition of Acetate of Silver by Iodine at a High Temperature.—M. Birnbaum.—When a mixture of acetate of silver and iodine is submitted to heat, there ensues, at a comparatively low temperature, a very strong reaction, the products of which, partly vapours, and partly permanent gases, were, by suitable means, condensed and collected by the author. Among the condensable vapours, he found acetate of methylic ethyl, boiling at 55°, and hydrate of acetic acid. Among the gases, carbonic acid, acetylen, and, beside this, another carburetted hydrogen were found. The solid residue of the reaction consisted of iodide of silver and some carbonaceous matter. The author enters into a very lengthy discussion as to the origin of the different substances found, but we cannot follow him therein, since it would require the reproduction of an enormous series of formulæ. When acetate of silver is heated by itself, a very violent reaction ensues, which sometimes even comes to actual combustion. The reaction yields acetic acid, and, among the gaseous products, CO_2 and marsh gas. The residue in the retort was found to consist of metallic silver and carbon.

Definition of the Place to be Assigned to the Benzol Series.—M. V. von Richter.—A paper not suited for abstraction.

New Method of Formation of Ortho-Chlorobenzoic Acid.—M. Wroblevsky.—When sulpho-diazo-chlorotoluol is boiled with anhydrous alcohol, there is formed ortho-chlorotoluol, $O.C_6H_4Cl.CH_3$, a fluid boiling at 156°, and which, on being treated with chromic acid, yields ortho-chlorobenzoic acid, a solid substance, difficultly soluble in water, but readily so in alcohol, and fusing at 151°.

Behaviour of Toluidine towards Bromine.—W. Wroblevsky.—When, into an alcoholic solution of toluidine, a mixture of air and vapours of bromine are passed, a large quantity of dibromotoluidine, and only very little monobromotoluidine, is formed; the former precipitates, and is collected on a filter. After addition of water to the alcoholic solution, the filtrate is evaporated, and until after having ceased to give off acid vapours. Ammonia is then added, in order to precipitate monobromotoluidine. Dibromotoluidine—

$$C_6H_3Br_2(NH_2).CH_3$$

is a solid body, crystalline, fusing at 73°, soluble in alcohol and ether, not in water.

On Ethyl-Phenol.—MM. Beilstein and Kuhlberg.—The authors state, first, that it is just possible that tyrosin may be equal to amido-ethyl-para-oxybenzoic acid, $C_9H_{11}NO_3$, and they tried to obtain it (tyrosin) from ethyl-para-oxybenzoic acid, which latter acid may be made by acting upon ethyl-phenol with sodium and carbonic acid. The researches made by the authors, and described in this paper, are, as might be expected, of a very complex nature, their aim being the synthesis of tyrosin. We regret that the paper is not suited for further abstraction.

Moniteur Scientifique, No. 305, September 1, 1869.

This number contains, as usual, a series of very well written papers, but those which are original do not belong to the domain of chemistry. Among the *brévets d'invention*, we briefly notice that MM. Broemner and Gutzkow have obtained, in France, a patent for the manufacture of anthracen, by distilling the asphalte, employed for making street pavements, with super-heated steam, and a subsequent sublimation of the raw product obtained. The anthracen is converted into anthraquinon, by gently heating the former with twice its weight of nitric acid, sp. gr. 1·3 to 1·5, and washing with water the product obtained. The anthraquinon is converted into alizarine and purpurine (both are formed at the same time), by dissolving it in gently heated sulphuric acid, to which solution nitrate of protoxide of mercury is added. The material resulting from this reaction is dissolved in an alkali, filtered, and next precipitated by an acid, whereby variable quantities of alizarine and purpurine are obtained. This process of manufacture is already carried out, on the large scale, by MM. Meister, Lucius, and Co., at Hoechst, near Frankfort-on-the-Maine, and is a great improvement upon MM. Græbe and Liebermann's method. The editor of the French paper above named states that he received from the manufacturers just named a sample of a ½ of a kilo. of this artificially-prepared alizarine.

No. 306, September 15, 1869.

This number contains only the following original communication:—

A Letter from MM. Meister, Lucius, and Co., at Hoechst, near Frankfort-on-the-Maine (dated September 10th last), wherein these parties state that they are not manufacturing artificial alizarine by the method for which MM. Broenner and Gutzkow have taken a French patent. They also desire it to be understood that, for some time already, they have manufactured a substance which they call *alizapurine*, by a process kept secret. M. Camille-Kœchlin, of Mulhouse, after having very carefully tested a sample of the substance made by the manufacturers above-named, states:—"The sample sent, though it is not truly an alizarine in the strictest sense, since it differs, in many respects, from genuine alizarine, as obtained from madder, or as that lately produced by artificial means, yields, however, in its application, colours superior to those obtained from madder and any of its commercially made products; and no doubt the material made by MM. Meister and Lucius will be the madder of the future." M. Kœchlin adds—"The paste, for in that state it is obtained, I experimented with has fully five times the tinctorial power of madder, and all the colours are more brilliant.

The other papers contained in this number are not original, and, excepting the *brévets d'inventions*, are already either published by us in full—as, for instance, Mr. Abel's paper on explosive substances—or have been abstracted by us from the original publications in which they appeared.

Revue Hebdomadaire de Chimie, September 9, 1869.

Apparatus for the Liquefaction of Protoxide of Nitrogen and other Gases.—M. Deleuil.—The apparatus, of which an excellent woodcut is given, is an improvement upon the very generally used and well-known apparatus of M. Natterer, of Vienna, and, in principle, the same—viz., a force-pump, to the piston of which an upwards and downwards movement is imparted by means of cranks and wheel-work. The recipient for the condensed gas, and the body of the pump, are surrounded by a strong freezing mixture, and the recipient is provided with properly constructed valves, whereby it is possible to make, with ease and comfort, and without danger, experiments with liquefied gases in a lecture-room; while the apparatus for condensing the gases is placed in a separate room by itself. Without reproducing the cut, we cannot enter into more details on this subject. The price of the apparatus complete is, at Paris, 1900 francs (£76).

Annales de Chimie et de Physique, August, 1869.

This number contains only one original paper, or, rather, a lengthy essay, on—

Interrupted Currents.—M. A. Cazin.—This essay is strictly of a mathematico-physical nature, and not suited for abstraction.

Bibliothèque Universelle et Revue Suisse.—Archives des Sciences Physiques et Naturelles, No. 140, August 15, 1869.

This number does not contain any original paper relating to chemistry or allied sciences.

TO CORRESPONDENTS.

J. Cox.—The subject of your query has already been fully discussed in these columns.

W. H. Hindmarsh.—We know of no analytical practice for disposal just now, or of a partnership in chemical works. By repeating the advertisement, you would probably hear of one. A Mr. G. Green, of 5, Sebbon Street, Islington, has written to us for your address, as he wishes to have his certificate returned.

W. R.—Chloride of iron can only be economically prepared on the large scale at chemical works, where hydrochloric acid can be had at a mere nominal cost. Your other questions can be better answered by a few practical experiments, than by written descriptions. The last of Dr. Angus Smith's articles, "On the Examination of Water for Organic Matter," appeared in No. 510.

Biggs, Holland, and Biggs.—We do not know the address of MM. Græbe and Liebermann, but a letter to the care of the publishers of the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin* will probably reach them.

THE CHEMICAL NEWS.

VOL. XX. No. 516.

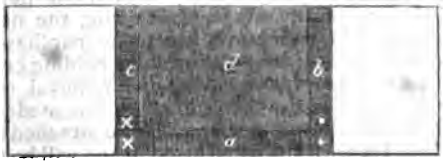
ON MICROSCOPICAL MANIPULATION.

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 171.)

A VERY useful trough for viewing objects in fluid can be made with a slight amount of trouble. Cut in half an ordinary 3 × 1 slide (Fig. 14, shaded portion in centre). From this cut off the strip *a*, then the pieces *b* and *c*, and reject the centre piece, *d*. Before cutting, it is well to mark the adjacent edges with ink, as indicated in the figure, to prevent any mistake in putting them together afterwards. The three pieces *a*, *b*, and *c* are to be cemented with marine glue on the middle of a slide, and, as the cut portions, if replaced as directed, fit each other accurately, there is no occasion for grinding. The trough is completed by fastening an oblong piece of thin cover-

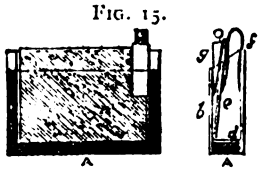
FIG. 14.



glass on the upper surface. For this purpose it is better not to use marine glue, as the cover frequently requires removal, as, from its thinness, it is liable to be broken in cleaning. It can be best secured by the use of the following, known as "electrical cement," from its having been used to fasten various portions of electrical apparatus together:—Melt together five parts rosin, one part bees'-wax, one part red-ochre, two parts Canada balsam; mix well, and pour into pill-boxes of convenient size. This cement is most conveniently used with a miniature soldering bit, which is rendered more comfortable to use by its being balanced with a plug of lead in the handle. With a little practice, a very neat joint can be made. The cement is also useful for many other purposes, of which notice will be taken in the proper place.

Larger troughs, having sides of plate-glass, can be made by those who will take the necessary trouble. In this case, the surfaces to be cemented must be

FIG. 15.



accurately ground. Such vessels are very useful in looking over the results of pond-hunting with a low power for the purpose of selecting such objects as may be required for more detailed observation. The troughs, of various shapes, can be purchased at most opticians.

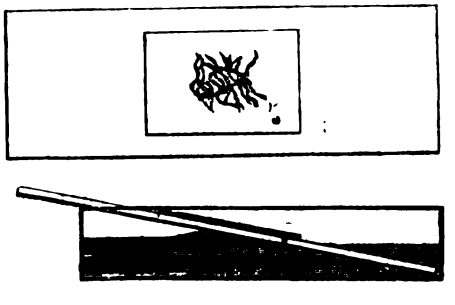
The form represented in Fig. 15 is particularly convenient, as by means of the whalebone spring, *f*, and the wedge, *g*, the space between the front glass, *b*, of the trough and the inclined plate, *c*, is capable of adjustment, so that an object can, when desired, be kept close to the front glass. These parts can be removed when a greater depth of water is required for larger objects.

A simple and useful contrivance, to be used as a growing-slide, has been described by Mr. C. J. Muller (*Monthly Microscopical Journal*, vol i., p. 174). The object of a growing-slide is to keep alive any minute water-plant or animal, the development of which it is wished to observe. Many plans have been devised for this purpose, but none equal in simplicity or efficiency that now to be described.

An ordinary 3 × 1 slide (Fig. 16, A) is pierced with a minute hole at about 3-10ths of an inch from the centre on one side. When an object under investigation is put upon it immersed in water, the thin glass cover is so placed as to include this hole, which should be near its margin. When it is desired to keep the specimen moist while off the stage of the microscope, the slide is placed in a small flat trough (B) in an oblique position, object uppermost, with one

FIG. 16.

A



B

end (that nearest the hole) resting against the bottom of the vessel on one side, and the other resting upon the edge of it. Sufficient water is put into the vessel to admit of the liquid reaching within a ¼ or ½ an inch of the glass cover on the uppermost side, when it will be found that the water on the under side reaches beyond the centre of the slide, and consequently beyond the hole with which it is pierced. In this state, the object will remain moist so long as the trough contains a sufficient quantity of water. When required to be placed on the stage of the microscope, the water is easily wiped off the slide, without any disturbance of the object.

Mr. Muller's original trough was made of tin-plate, but, as this material is liable to rust when long in use, Mr. F. W. Gay has had them made of pewter of an improved form, which has proved an effectual remedy for this defect. Thus constructed, they are to be obtained of Mr. C. Baker, Holborn.

The process of attaching cells to plates of glass has been given; but nothing has been said about the material of the rings forming the cells. When required of some considerable depth, rings made of slices cut from thick glass tubing answer admirably. If square or oblong cells are required, they can be

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

cut from tubes of suitable form. Very useful cells are now made by Mr. Collins of pure tin of various thicknesses, from that of thin writing-paper up to that of a thick tube cell: several sizes can also be procured in each thickness. Tin is not acted upon by any of the fluids used in preserving microscopical objects, and has the advantage of being much cheaper than glass, and at the same time equally efficient. Cells of unusual form can readily be cut from the sheet-tin with a penknife or pair of scissors, and circles can readily be punched. The adhesion of the cover-glass is improved, and the process of mounting in fluid much facilitated, by grinding the upper surface of the cell after it is attached to the slide with water upon a Water-of-Ayr stone, as suggested by Dr. Carpenter. This gives a beautiful surface, and ensures the perfect fit of the cover, and renders the closing of the cell a matter of greater certainty than it would be if the natural surface of the metal were used.

Some very useful aids to the examination of microscopical objects, and which can readily be made by the exercise of the smallest amount of mechanical ingenuity, are described by Mr. S. J. McIntire, in the *Transactions of the Quekett Microscopical Club*, vol. i., p. 69. One of these is of such general application that it will be well to describe it. A piece of sound sheet cork, about 2 in. by 3½, or other convenient size, and of a thickness suited to the purpose for which it is intended, is perforated with an oval or circular hole; this may easily be cut with a penknife or sharp chisel, and the edges finished with a file. The cork is placed between two pieces of glass of similar size, the lower one being covered with a few layers of pink blotting paper, and the whole contrivance kept together with two india-rubber rings. The cell so constructed is used for keeping alive small insects that inhabit damp situations, such as *Poduræ*. The moisture is readily supplied by dipping the end of the slide into water, which is absorbed and retained by the blotting paper. The proper food of the insects can be placed in the cell. By the aid of this simple contrivance, Mr. McIntire has been enabled to make some most interesting observations on the habits of the *Poduræ*, which have been kept living in these cells for many months. This plan admits of modification to suit the object under observation. In the author's researches on the blow-fly, it was necessary to use thin glass, and to have the means of viewing the object on either side; this was accomplished by cutting a rectangular hole in a suitable piece of cork, placing the thin glass on either side, and securing it by bending on its edges strips of the sheet tin used for making cells which had been inserted in the cork, which effectually fastened the glass in a somewhat similar manner to that by which a stone is set by jewellers, and readily permitted its removal when required.

Among the tools employed by the microscopist, none are more generally in request than needles of various sizes and forms. They are frequently required of various curvatures; this bending can readily be performed by the microscopist himself. If a needle is heated to redness in the flame of a spirit-lamp, and allowed to cool, it can easily be bent or twisted into any required form. Steel so treated, if heated again to redness and suddenly cooled in water, becomes excessively hard and brittle; in this condition, it is capable of scratching glass, but is too fragile for dissecting instruments. The right temper for the dissecting needles is obtained by heating and cooling in tallow or oil; this, with needles, may be readily done in a common tallow (not composite or paraffin) candle. While the needle is soft, it may, by the exercise of a little dexterity, be hammered out so as to form a small knife, or lancet, which can then be hardened so as to take a cutting edge; many useful instruments can also be made out of small pieces of steel. Needles and cutting instruments are best sharpened upon a very hard, white stone, known at the tool shops as Arkansas oil-stone; it cuts very rapidly, and gives an extremely fine edge. Scissors, when blunt, may readily be sharpened on the oil-stone, by opening the blades and rubbing them on the stone, holding them nearly upright. The burr produced by this operation need not be ground off, as it is soon removed when the blades are worked together; the screw is to be tightened if required. For delicate dissections, the steadiest cutting instrument is a kind of scissors, made almost exactly like a minute pair of sheep shears, and known as the microtome; in use, it feels very much as if the fingers were extended and armed with cutting edges. There is hardly any other cutting instrument so much under the control of the operator.

The best handles for needles and other small instruments are made of cedar pen-holders into which the needle, with the eye broken of, is inserted with a pair of pliers. Very convenient handles, which have the advantage of allowing the needles to be removed at pleasure, are to be purchased at fancy warehouses; they are used for holding crochet hooks; they are improved by the removal of the ivory handle, and the substitution of one made of a cedar pen-holder, which can easily be attached to the metal socket with electrical cement, and will be found to be lighter and more pleasant in use.

(To be continued.)

A NEW AND ECONOMICAL METHOD
FOR EFFECTING THE
EXTRICATION AND CONDENSATION OF AMMONIA FROM GAS LIQUOR
FOR PURPOSES OF CHEAP CARRIAGE, AND FOR FACILITATING THE MANUFACTURE OF AMMONIACAL SALTS.*

By FREDERICK BRABY, F.G.S.

It is but a very few years since that the various by-products obtained from the manufacture of coal gas were not merely a drug in the market, but proved an absolute nuisance to the manufacturer and to the general public.

Coal tar was even burnt under the retorts, or was introduced therein for the production of gas; and gas liquor was commonly given away to anyone whose ingenuity might enable him to turn it to a useful purpose.

But the progress of science in this, as in other cases, soon discovered applications where none were supposed to exist.

From coal tar are not only now obtained naphtha, benzol, carbolic acid, and other valuable derivatives, but also the brilliant and diversified colours of what are called aniline dyes are obtained from the same source. The ammoniacal liquor, too, to which, on the present occasion, I desire to be favoured with your attention, is now not only not given away in the Metropolitan and other districts, but, in certain localities, the greatest competition exists for its acquisition. It at present constitutes, in this country,

* Read before the British Association, Exeter meeting, Section B.

the principal source of ammonia, and, consequently, of the ammoniacal salts, which are so usefully and so successfully applied in the arts, and more especially to agriculture. In London and its neighbourhood, the purchase of the residuary products of the various gas companies is eagerly sought after, and it is now considered a privilege to be allowed permission to tender for them for the term of one, two, or more years, supply. Practically, the tar and gas liquor trade is in the hands of a few parties jealously desiring to exclude outsiders, who thus find it extremely difficult and often absolutely impossible to obtain even a few thousand gallons.

The object of the present communication is to show how the demand for gas liquor which so far exceeds the means of actual supply can be met. It is to show, moreover, that by condensation and reduction of bulk for transport, small and remote gas works may be enabled to utilise and export their residual products at a profit; and above all, how, by the introduction of certain improvements, the quantity of ammonia as produced and utilised from the manufacture of gas, may be practically increased from ten to fiftyfold.

The strength of gas liquor is commonly specified in the various tenders as technically 6 oz. The prefix, denoting the number of ounces, refers to each gallon of the liquor, and does not signify the number of ounces of ammonia that are present, but the number of ounces of sulphuric acid which would be required to neutralise the ammonia. Consequently a butt of 108 gallons of 6-oz. liquor implies, by calculation, that 108 times 6 ozs. or 40 lbs. of sulphuric acid are required to saturate the whole quantity. Now it is found in practice that, if we divide the quantity of sulphuric acid required by 3, we shall get at the quantity of ammonia actually present. This result closely agrees with theory, the equivalent of dry ammonia being 17, and that of monohydrated sulphuric acid (oil of vitriol) being 49; the proportion is very nearly 1 to 3, It follows, therefore, that, as 40 lbs. of sulphuric acid are required to saturate a butt of 6-oz. liquor, so one-third of this or little more than 13 lbs. of real ammonia are contained in this immense quantity of liquid and merchantable product, weighing as it does in the aggregate no less than 1107 lbs., or half a ton. On referring to the ordinary commercial standard, viz., of 6 ozs. to the gallon, 6 ozs. of sulphuric acid divided by 3 gives 2 ozs. of ammonia as the entire quantity present. Now a gallon of the gas liquor weighs 10 lbs. and, if the lbs. be multiplied by 16 to reduce them to ounces, we have a total of 160 ozs., containing only 2 ozs. of real ammonia or 1 oz. to 80 ozs. of water.

The result of this is, practically, to prohibit the transport of gas liquor over any but moderate distances, because, in its present form, for every ton of real ammonia carried by barge, tank-cart, or otherwise, no less than 80 tons of water must be carried for no other purpose but as a solvent. It must not be inferred, however, that the *whole* of these 80 tons of water is waste carriage. Ammonia in a free state cannot be conveniently carried, except when dissolved in a certain quantity of water. It would not be judicious to concentrate the ammonia to a higher degree than 0·900, since if, in course of carriage, it were subjected to any great degree of heat, the water at an elevated temperature would disengage some of the NH_3 held in solution, and such a disengagement of ammonia might be attended with dangerous results. A very useful and safe solution for all purposes of transit would be about one part by weight of ammonia to four parts of water; this would reduce the present cost of carriage for this important article to no less than twenty times, or, in other words, the transit of a certain quantity of ammonia over a certain distance costing now £20 would, if conveyed in the above concentrated form, be reduced to 20s. This scale of reduction would at once enable it to be carried by rail in petroleum or other barrels, or in tank-trucks, or otherwise, and would bring the numerous gas works which are scattered over the United Kingdom within economical transport of the centres of manufacturing industry, so that this important bye-product of gas-making might be utilised for the general good, and be not so extensively wasted as has been, and is now, frequently the case.

In order to effect this desirable object, I recently, in conjunction with Mr. Baggs, secured a patent for effecting the necessary concentration of ammonia by certain novel means, which promise in practice to prove far more rapid and economical than any hitherto employed. The process may be shortly described as follows:—To the common ammoniacal gas liquor a certain quantity of slaked lime is added. The liquor thus treated is placed in a capacious boiler or still containing from four to five thousand gallons. The whole is then heated and maintained at a temperature of from 100° to 200° F., the liquor being slowly but constantly stirred by means of an internal agitator, the spindle of which passes through a stuffing box in the end of the boiler. A powerful blast of air from a double-action force-pump actuated by a small steam-engine or otherwise, is blown continuously through the liquor. The air enters by two long perforated pipes placed near the bottom of the boiler, and in its upward passage it is compelled to pass through a horizontal diaphragm drilled with numerous small holes. The result of this arrangement being that the air, in its ascent, is subdivided into innumerable small sheaves and bubbles, to each and all of which, in accordance with well-known and recognised laws, the ammonia attaches itself and is carried away with only a very small proportion of aqueous vapour. An exit pipe is fixed to the top of the boiler, so as to carry away the mixture of air and ammonia, and the extremity of this pipe dips into a supply of water contained in a cold and suitable receiver, where the ammonia is immediately absorbed, and the air after thus effecting its removal in a separate state, escapes through the water and is permitted to pass off into the atmosphere. The condensers are generally arranged like a series of what are known as Woulfe's bottles, but for the purpose of obtaining great strength and purity, this arrangement may be superseded in the manner following.

The ammoniacal gas separated by the air is purified in a manner which will be afterwards described, and is then caused to pass into a vessel about three parts filled with broken lumps of pure block ice. From the well-known affinity of ammoniacal gas for cold water, the gas is arrested by the ice, which is rapidly liquefied, and a pure solution of ammonia of any required strength is obtained. It is advantageous to cool down the mixture of air and ammoniacal gas before it is allowed to enter the condenser; the air after having parted with the ammonia which has been dissolved by the liquefied ice, passes off into the atmosphere as in the former instance. The finest Norwegian transparent block-ice may, in the height of summer, be obtained at the London Docks at 23s. per ton, and even less, according to the number of tons required, the supply being constantly maintained by the arrival of fresh ships. Or ice may be obtained by one of Siebe's refrigerating machines almost as cheaply as that which is imported.

This patent process for separating the ammonia by blowing air through gas liquor, when at an elevated temperature, is so much more rapid in the operation than the process of merely boiling the gas liquor as hitherto conducted that, with a very moderate-sized apparatus, several thousand gallons of gas liquor can be treated in a single day, and the ammoniacal produce of the largest works may be continuously converted into a concentrated and more portable form without trouble or delay. Even in the smallest works, consuming not more than from ten to fifty tons of coal a week, the bulk and weight of the gas liquor may be quickly reduced, and the result will be of such standard value that a still containing from 20 to 100 gallons would, probably, in such cases, answer every desired purpose, and would be found to be remunerative. In many instances the gas liquor might be heated and the power supplied, if desirable, from the waste heat of the retorts.

By the adoption of this improved process the present trade in crude ammonia may be expected to expand and to become of higher importance than it now is.

The comparatively limited supply which is now available restricts its application. The commercial advantages which would be derived from the many technical purposes to which it is applicable would be considerable, and manufacturers being enabled to obtain cheap supplies from distant sources, the total quantity utilised would be immensely increased.

When, instead of producing caustic ammonia it is desired to manufacture ammoniacal salts, the ammoniacal gas in conjunction with the atmospheric air may be conducted into sulphuric or muriatic acid, or into a metallic or saline solution capable of appropriating the ammonia.

As the evaporative power of air increases with the absence of moisture therein, it is possible that, by drying the same artificially before introducing it into the liquor, it would take up a great quantity of ammonia. The removal of all moisture from air may be effected with comparatively little expense by the suction of the air required for the force-pump through sulphuric acid, and a close wooden box containing lumps of chalk. This method is well known in connection with other applications.

The blast of air may be hot or cold, and may be delivered in any manner adapted to increase and effect more intimate contact between the air and the liquid containing the ammonia.

By adopting what I call the atmospheric or blowing principle, nearly the whole of the ammonia can be liberated from the solution in which it is contained, without any fire or external heat applied to or under the still or boiler, but, if the liquor be heated, the solubility of the alkaline gas is diminished and its extraction is facilitated.

Gas liquor is, in this country, the most common, and at the same time the most economical, source of ammonia, and the system of extraction by forcing air would, of course, be equally applicable to ammoniacal bone liquor, or to any other chemical preparation in which the caustic ammonia is held in solution.

(To be continued).

NOTE ON THE EARLIER HISTORY OF THE SCIENCE OF HEAT.

By GEORGE FARRER RODWELL, F.C.S.

As a supplement to the lectures on "Heat" which have recently appeared in this journal, it will not, I think, be out of place to give a short account of some of the principal facts connected with the earlier history of the science of Heat. In doing this it will be impossible to preserve any great continuity, my object being rather to indicate some of the old scientific treatises in which experiments are detailed, and to supply the student with a means of reference which the foregoing lectures of necessity could not afford. The memoirs and the works of recent writers on Heat are so well known and so much at the command of all who desire to pursue the study, that it will be sufficient to mention the names only of Cazin, Clausius, Despretz, Franz, Guthrie, Helmholtz, Herschell, Hirn, Joule, Knoblauch, Kopp, Magnus, Mayer, Melloni, Pouillet, Regnault, Balfour Stewart, Tait, Thomson, Tyndall, and Wiedemann.

It is difficult to say when the science of Heat, properly so-called, first arose. It is certainly a younger science than Statics, Dynamics, Hydrostatics, Hydrodynamics. Pneumatics, Optics, Static Electricity, and Magnetism. I question whether Acoustics can be added to this list, although it has ever had the stimulating effect of the art of music, which, in its turn, had the stimulating effect of Church Ceremonial, and attained some perfection in the 16th century, and much perfection in the 18th. M. Libri very truly says "Les recherches des Pythagoriciens sur les vibrations des corps sont les plus anciennes expériences de physique qui soient parvenues jusqu'à nous,"* but we must bear in mind that the results of these experiments were applied to music as an art, rather than to sound as a science. Omitting, then, the question of the precedence of Acoustics, we yet perceive that Heat is amoung the younger of the sciences. This arises from the fact that, until late in the last century, heat was regarded as a chemical agent, and became merged more or less into chemistry proper. Separate treatises on Heat were unknown, but every chemical work devoted some chapters to the acts and operations of fire, "Car en effet," as Lemery remarks, "c'est par le moyen du feu qu'on vient à bout de presque toutes les opérations chimiques." Hence arose such expressions as "Chymick heat," "ye hete of ye chimists fornace," &c., to designate intense degrees of heat. Then, again, the theory of Phlogiston is essentially a heat theory in one sense, but it has ever been regarded as a chemical theory, because the action of heat is so closely associated with the majority of chemical operations that the scientific cared not to step aside to examine the nature of heat itself, preferring to leave the examination of the cause to study that of the ultimate effect. Boerhaave in his admirable *Elementa Chemiæ*, the most extensive chemical work which had up to that time (1732) appeared, devotes a good deal of space to the "instruments" of chemistry, "beginning," as he remarks, "with fire, by reason that no chemical operation ever was, or can be hereafter performed, to which fire does not contribute." (It may be remarked here that *fire* and *heat* were often used as almost synonymous terms by old writers; thus Boerhaave says "Fire expands even the hardest bodies.") I imagine that Francis Bacon's little treatise, *De Formâ Calidi*, was the first attempt to raise Heat into a separate science. It was an utter failure, yet the attempt is to be applauded, for it was the lack of observation and the paucity and obscurity of the knowledge possessed at that time by the world at large in regard to heat, that of necessity resulted in the failure. What are we to say to such an assertion as the following? "Omnino calor cælestium augetur tribus modis; videlicet ex perpendiculo, ex propinquitate sive perigæo, et ex conjunctione sive consortio stellarum." S'Gravesande in his excellent *Physices Elementa Mathematica*—one of the best illustrated works on Physics which has ever appeared, and which may even now be consulted with advantage,—gives 45 pages ("Editio tertia, duplo auctior," 1742) to heat, and 234 to light. He commences the "Liber de igne" with the very pertinent remark in his blunt rugged Latinity, "Pauca de igne norunt philosophi; multa ipsos latent," adding very sensibly (and it is to be wished that his example were more often followed) "Hypotheses non fingam; generaliora, quæ experimentis deduci posse mihi videntur, eo quo potero meliore ordine, dicam."

The production of fire by the refraction and reflection of the rays of the sun was well known to the ancients. The sacred fire of Vesta was re-kindled by the rays of the sun reflected from a metallic mirror, and, according to Pliny, the mirror was sometimes replaced by a glass globe filled with water. Aristophanes clearly alludes to the use of glass lenses as burning glasses in the Νεφελαι.

Lactantius, in his curious treatise, *De ira Dei*, mentions that a glass globe filled with water and placed in the rays of the sun, will kindle fire even in the coldest weather.† Baptista Porta in his ever new, ever interesting treatise, *Magiæ Naturalis*—which links the magic of Art of Eastern

* "Histoire des Sciences Mathématiques en Italie." 1838.

† Lactantius was born about A.D. 250; he died in 326. His works were amongst the first printed in Italy; the first edition issued from the press of the monastery of Subiaco as early as the year 1465, while a second issue appeared in Rome in 1468, in both cases it will be remembered before a single book had been printed in this Island. The passage alluded to above is taken from the tenth chapter, entitled "De mundi ortu, et rerum naturæ, et Dei providentia," and is as follows—"Omitto silicem, ac ferrum. Orbem vitreum plenum aquæ si tenueris in sole, de lumine, quod ab aqua refulget, ignis accenditur etiam in durissimo frigore."

civilisation with the magic of Nature of Western civilisation, Chaldæan mysticism and Theurgy with the Realism of the Renaissance,—Baptista Porta mentions the fact that heat, sound, and cold may be reflected by mirrors in the same manner that light is reflected. As a delicate instrument of observation in the case of the reflected cold, Porta placed his eye in the focus of the mirror, as, some two and a half centuries later, Dr. Tyndall placed his eye in a focus of dark heat rays in order to see whether any light accompanied the heat rays. Porta's account is interesting; it occurs in the seventeenth book, and is entitled "Calorem, frigus, et vocem speculo concavo reflectere." "Si quis candela in loco," he continues, "ubi spectabilis res locari debet apposuerit, accedet candela per aerem usque ad oculos, et illos calore et lumine offendet, hoc autem mirabilius erit, ut calor, ita frigus reflectitur, si eo loco nix objiciatur, si oculum tetigerit, quia sensibilis etiam frigus percipiet." Somewhat later Hamerus Poppius calcined antimony "per radios solares" with the use of a lens, in order to determine whence came the gain of weight. Bonaventure Cavalieri, the discoverer of infinitesimals, writing in 1632, states that he was able to inflame dry substances by reflecting the heat emitted by a charcoal fire by means of a spherical speculum; by using a parabolic reflector he produced the same effect at a distance of 5 feet, a small fire of wood being the source of heat. He recommends a hyperbolic reflector, and asserts that the impressions of heat, cold, sound, and scent move in straight lines.* Athanasius Kircher has also treated of reflection in his *Ars Magna Lucis et Umbræ*.

The term "radiant heat" was introduced by Scheele in his treatise entitled *Luft und Feuer*. Pictet in his celebrated *Essais Physiques sur le Feu* (1790) demonstrated the enormous velocity of propagation of radiant heat; he also treats of the absorption and reflection of heat, and of latent and specific heat. Prevost made known his "Theory of Exchanges" in 1791 through the medium of the *Journal de Physique*.

Black discovered "latent heat" about the year 1760; his pupil Irvine introduced the term "capacity for heat," while Gadolin replaced it in 1784 by the term "specific heat." In connection with the determination of the specific heats of various substances, the following names are most prominent:—Wilke, Lavoisier, Laplace, Kirwan, Dalton, Dulong, Petit, De la Rive, Regnault, Favre, Silbermann, Bérard, De la Prevostaye, and Desains.

As regards the air thermometer I am inclined to think that Galileo invented it about the year 1597; some attribute it to Sanctorio of Padua, others to Cornelius Drebbel of Alcmaer, while others, again, maintain that it was discovered by each of these men independently of each other. Some of the members of the Accademia de Cimento first constructed a fluid thermometer in 1655 or 1656. Edmund Halley introduced mercury in the place of alcohol. Otto von Guericke was the first to take the freezing of water as the lowest limit of the scale, while Renaldini, in 1694, proposed the boiling and the freezing points of water as the opposite limits of the thermometric scale. A kind of rude differential air thermometer is mentioned by Sturmius in his *Collegium Experimentale sive Curiosum* (1676). Sir John Leslie described the differential air thermometer which bears his name, in 1804 in his "Experimental Enquiry into the Nature and Propagation of Heat."

Leslie's principal work is his "Essay on Heat" in which he described the radiative and absorptive power of various substances, and determined the laws which regulate the radiation of heat. He maintained, however, that air is as essential to radiation as it is to convection.

The subject of the conduction of heat was discussed at some length by Lambert in his "Pyrometrie" published in 1779, but the earlier mathematical treatment of the subject is due to Fourier, and is detailed in a paper entitled "Thèorie Analytique de la Chaleur," communicated to the Academie des Sciences in 1807. His definition of conductivity is extremely lucid, and he has treated of the cooling of an uniformly heated sphere with great ingenuity and elaboration. Poisson and Carnot have also applied the higher mathematics to the elucidation of various questions connected with the science of heat, and in our day Helmholtz, Clausius, and Thomson.

Mariotte and Hooke observed that glass cuts off many of the rays of radiant heat. M. De la Roche discovered in 1812 that radiant heat which has passed through glass has lost the rays which glass most readily intercepts, and that, as the temperature of the radiating source rises, so does the readiness of the radiant heat to pass through glass increase. Nobili and Melloni worked together on the subject of radiant heat. The former invented the thermopile, while the latter made the important discovery that rock-salt is very transparent to all kinds of heat, and that, by using lenses and prisms of rock-salt, dark heat rays may be refracted exactly in the same manner that light is refracted by glass. These results were published in the celebrated treatise entitled "La Thermochrose, ou la Coloration Calorifique," and were at first received with some credulity by the Parisian *savans*.

The most notable experiments in connection with the polarisation of heat were made by Bérard in 1812 (*Memoires d'Arceuil*, vol. 3), and later by Forbes.

The Abbé Rochon endeavoured to determine the comparative heating effects of the various coloured rays of the spectrum as early as the year 1776; he employed a flint-glass prism and an air thermometer, and reckoned the heating power of the red rays to be about eight times greater than that of the violet. In 1798 Leslie (?), by using a differential air thermometer, found the calorific energies of blue, green, yellow, and red to be as 1 : 4 : 9 : and 16. In 1800, Sir William Herschell employed a small mercurial thermometer for the same purpose, and arrived at the conclusion that the hottest part of the spectrum is beyond the red rays. A detail account of recent research on this subject (specially of the "long spectrum of the electric light") will be found in Tyndall's work "On Heat treated as a Mode of Motion."

The history of heat theories has not been alluded to above because the history of the kinetic theory was discussed at some length in the first of the foregoing lectures,* and I have elsewhere† treated of one of the phases of the material theory. Bergman's *De Materia Caloris* may also be consulted by those who are interested in this part of the subject. Of recent works on Heat I would specially mention Clausius "On the Mechanical Theory of Heat;" the treatise of Tait "On Thermodynamics;" the *Théorie De la Chaleur* of M. Desains, and the *Thermodynamique*, of M. Bertin ‡

It is hoped that the above facts—desultory though they be—may be of interest to those who desire to follow the literature of the science of Heat in greater detail than is possible in lectures, which are rather for purposes of demonstration than for the discussion of facts connected with the history of a science.

International Exhibition of Amsterdam.—Professor Pepper is now giving an instructive lecture at the Royal Polytechnic on the "Tentoonstelling." While speaking highly of the inhabitants, the lecturer refers at length to their industrial pursuits, and illustrates the lecture with enlarged views of the Exhibition as well as some curious costumes worn by the Netherlanders. The lecture occupies less than an hour in delivery, and gives a very clear idea of the country and its people.

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* Cavalieri was born in Milan in 1598; he died in 1647. The above is extracted from a work entitled "Lo specchio Ustorio: ouero trattato delle settioni Coniche et alcuni loro mirabili effetti intorno al lume, caldo, freddo, suono, et moto ancora." Bologna, 1632.

* CHEMICAL NEWS, vol. xx., p. 13.

† "On the Theory of Phlogiston," *Philosophical Magazine* for January, 1868.

‡ The last two treatises are published in the *Recueil de Rapports sur l'état des Lettres et les Progrès de Sciences en France*, a series of which it would be difficult to speak too highly.

THE LATE DR. THOMAS GRAHAM, MASTER OF THE MINT.*

On Thursday, September 23rd, the remains of this distinguished man, attended by a number of his sorrowing relatives and personal friends (among the former of whom were his sister, her husband, and family), were conveyed to their last resting place in the High Church Burying Ground, Glasgow.

But few persons were privileged to any intimate acquaintance with Dr. Graham. He was never strong enough physically to allow him to mix much with society; he was always, or with rare exception, strong enough to toil in the field of science. Even scientific men, owing to his retiring habits, have not seen so fully the bearing of his labours, as they have seen of that of others in kindred pursuits, which will have much less influence. The reason of this will be at once apparent when we consider that he never pursued a merely popular or fashionable subject of investigation, and that he never sought a fashionable assembly in which to disclose the results of his labours, nor did he ever leave his own field of inquiry, although all the highways around him were bustling and busy, and if any person occasionally ventured near him it was only to find that there was nothing to be seen till he pointed something out. We do not pretend to be able to see and appreciate the entire significance of his scientific life—it would for this require much more study than we have given to it—and it will probably require many years for scientific men to develop the ideas originated by him. We can only endeavour to picture to ourselves the scene as he found it, and again as he left it touched by his master hand. Picturing in this connection is scarcely the right word—slight sketching is a phrase too strong for all that we can here attempt.

The general mind of the time has not yet arrived at a right apprehension of chemistry proper. The prevailing notions on the subject, even among well-educated persons, relate to the chemistry of a byegone time, and belong rather to the end of the last century than to the science of the present day. In that earlier time, the elements or simple bodies had been increased in number, and it was that there existed numerous bodies hitherto unsuspected. England had proved the existence of many of these elements, France had arranged them, adding more, and giving a theory of their action, and making a preliminary science from the materials thus created. Lavoisier saw first the qualities of combinations made by metals and other solid bodies with gases, and gave us a definite and clear nomenclature for the science. Wenzel and Richter tried long to make it clear that the constituents of substances must be proportionate and definite, but it did not appear possible to perceive by what innate process these proportions could be produced, and the whole question seemed to involve an inpenetrable natural mystery. Dalton, in the simplicity of his mind, looked on matter as composed of exceedingly small bodies, probably round in form, like those conjectured by his great predecessors, from Leucippus to Newton, and thought that if we have one substance represented by black marbles, and another substance by white marbles, neither of which could be broken or divided, we cannot help forming definite compounds in chemically uniting them. That great idea of Dalton has been at the root of all advance in the science, and if any analysis is in contradiction to it, we at once deem it incorrect. When Dalton was publishing his opinions Graham was born, and it seems that from very early manhood it had been his desire to know more of the movements of these atoms. In a paper by him as early as 1829, he showed that diffusion of gases takes place among ultimate particles or atoms, and not between sensible masses. This, then, was a new step. Dalton had shown why they combined in definite proportions, Graham showed that there was another property, a distinct movement—a vitality, so to speak, among the atoms. If, as Graham found, gases diffused through porous substances, such as he operated with, they were not driven forward mechanically, so that the mixture should pass like water, but the diffusion volumes are inversely as the square root of the densities of the gases employed in the experiment. If the gases were pressed out or expelled from the containing membrane, no air would return to supply their place; but it was found there was always an interchange of gases—for example, when hydrogen (contained in a tubular glass vessel having its open ends closed with stucco plugs), spontaneously passed through the stucco, air passed in with a velocity denoted by 1277; if carbonic acid were used it passed out, whilst air passed in with a velocity of 623 only. Chlorine being used, the air passed in with a velocity equal to 302. From these results Graham was led to believe in Dalton's idea that gases were as *vacua* to each other—an imperfect explanation of the phenomena—although it was empirically correct. In 1831 he said—"The law at which we have arrived, which is merely a description of the appearances, and involves, I believe, nothing hypothetical, is certainly not in accordance with the corpuscular philosophy of the day, and is altogether so extraordinary that I may be excused for not speculating further upon its cause till its various bearings and collateral subjects be fully investigated." Graham leant, however, to the belief that the cause was the existence of an attraction of the particles of one gas for the particles of another, an attraction existing on the surface of the gaseous molecules. This idea led him to study the diffusion of liquids. In this inquiry he came to the conclusion that "diffusion" is a property of a fundamental character upon which the properties depend, such as the volatility of substances. Liquid diffusion thus supplies the densities of a new kind of molecules. "The fact that the relations in diffusion of different substances refer to equal weights of these substances and not to their atomic weight or equivalents is one which reaches to the very basis of modern chemistry. In liquid diffusion we deal no longer with chemical equivalents or the Daltonian atoms, but with masses even more simply related to each other in weight than the former. Holding still by the chemical atoms we may suppose that they can group together in such numbers as to form new and large molecules of equal weight, or of weights which have a simple relation to each other. It is this new class of molecules which appeared to play a part in solubility and liquid diffusion, and not the atoms of chemical combinations." The vast importance of this conclusion, resting upon experimental evidence, every chemist will at once understand.

It will thus be seen that, after a struggle of twenty years, Graham was able to speak of chemical movements not essentially connected with the atomic theory of Dalton. Still, it must be remembered, that these are movements, not combinations. They had, however, an important bearing on decompositions produced by liquid diffusion.

It was in examining this question that he observed the low diffusive power of albumen compared to common salt, for example, and conceived a mode of proximate analysis for mixed animal fluids. Strange to say, he found this diffusive power of liquids was closely allied to volatility. This is due to a cause about the last that even cultivated people generally would have imagined. Diffusion, as practised, was simply the passage through a thin membrane of gelatinous matter, or, as we may say, of parchment-paper as the material used. By observing this, he was able to divide bodies in solution into two classes, severally called by him "Colloids" and "Crystalloids." If a liquid containing examples of these two bodies were placed in a vessel, one side of which is of parchment-paper, whilst on the other or outside of it there was water, it was found that the crystalloid substance passed through the paper into the water, whilst the colloid substance remained. In his earlier papers on

* Communicated.

the diffusion of gases, he had shown that it was only in the hypothesis of self-motion that we could account for the motion of the air within the smaller vessels of the lungs, as they could not be inflated or filled by the action of the chest and diaphragm, which removed only about 20 cubic inches of air at a time, while there were 300 cubic inches of air to he filled and emptied. In this paper on diffusion, the passages of saline fluids through membranes are explained; and the separation of bodies in solution is also shown by a similar self-acting process. We cannot follow him further into his ideas respecting colloid substances, which, he says, possess *energia*. He regards these latter as being matter in a dynamical state, whilst crystalloids are matter in a statical or rest condition. Ever, we should observe, does Graham look at the ultimate properties of bodies; he keeps the atom in view, or, at least, the fundamental matter, and always finding some new property regarding it, freed from the thousand years of exhausted speculation, but illuminated by experiment and answers obtained by such acute cross-questioning of Nature as no one before him, in that department, at least, ever equalled. We may say, further, without fear of contradiction, no one has succeeded, by such original paths, in obtaining an entrance into the domain of Nature. In speaking of diffusion through membranes, he makes it quite clear that the latter does not act as a filter. The substance is mechanically impenetrable: molecules pass through it, not masses. These molecules are moved by the power of diffusion. It was when examining the action of a septum of caoutchouc separating gases that his attention seems to have been called to the surprising passage of gases through the homogeneous substance of a plate of fused platinum, or of iron at a red heat, as discovered by MM. St. Claire Deville and Troost. He enquired if this had any relation to liquefaction, and concluded that such a term could only be applied in a vague way to bodies so elastic and volatile at an elevated temperature as the gases are, and hydrogen in particular. Still, since dissolving and liquefying must be allowed, with such a fact before us as silver retaining twenty volumes of oxygen at a red heat, Graham also believed that the absorption of gases by a liquid (such as carbonic acid by water) is not a purely physical effect. It appears to involve some relation in composition. In the composition of the bodies, he adds—"May a similar analogy be looked for of hydrogen to liquid on colloid bodies of the metallic class?" It was in following up this idea that he came to the conclusion that hydrogen might pass into metals, and form with them an alloy. This alloy he succeeded in making, and a medal of palladium and hydrogenium was struck in his honour. The hydrogen in this condition and connection was called hydrogenium, in order that the name might have a termination like the names of the metals which it resembled. The palladium contains nine hundred volumes of a substance so light as hydrogen, and so many thousand times lighter than itself. This brilliant discovery had other results. Iron was found to absorb gases when cooling; and it was, therefore, possible to know in what gas iron did cool by finding the gas shut up or included in it. The technical value of this may still be very great; but Graham cared little for such results. He sought cosmic truth; and he had a wonderful proof of his own correctness by the examination of cosmic phenomena. He found that the gas which was shut up in iron made by man was carbonic oxide, but the iron from space, or meteoric iron, contained hydrogen. This gas he took for us out of the meteoric iron, and burnt it. It was hydrogen. Strange that at that time a small star had increased in brilliancy, and become a large one. The spectroscopist found, by the evidence of the spectrum lines, that hydrogen was burning. Graham's quiet and, to all appearance, uninteresting, unimportant, and even dull, experiments, that nobody cared to share with him, had at last resulted in two of the most brilliant facts, which even cultivated minds must long wonder at and admire. Reference to one of his latest speculations must finish our present notice of this distinguished man. That gases have initial movements as one of their original properties, and that the speed of these movements severally may be their main distinction. This would take them out of the region of chemistry proper, and bring them into physics; but physics and chemistry are, after all, fundamentally one. A new field is unfolded to us; new work must be done, and new workers are required. Who among us will give up all the ordinary gratifications and amusements of life to work in this field like Graham? Who among his fellow chemists will do work worthy of being placed beside his? We may freely say that such another will not soon arise, and, if our country produces such a man in a century, she does her duty well, even if the rest are only of average powers.

We cannot go into the detail of the labours of Graham. We have left out his enquiries into the action of water, basic and constitutional, in chemical compounds; his able papers on the arseniates and phosphates; and we have said nothing of osmotic force by name; neither have we done justice to his enquiries on effusion and transpiration; but we have hastily, after his funeral, tried to remember the main points of a great scientific life, and we trust they will be more closely studied than heretofore by all scientific men. We are almost ashamed to allow such a meagre account to stand as representative of the labours of such a man; but it is only for a little, as a longer and more detailed life must soon be written by men who will give much time, care, and competent thought to every portion of the publication. We need scarcely speak of Graham in private. Such enquiries will always have one result in showing that he was pure-minded, just, generous, and kind-hearted to the uttermost. Humble he was, quiet, and as simple-minded to the last as if he were always the same hoping, trusting youth that he seemed to be when he first began to lecture in the Andersonian Institution thirty-nine years ago. By his death, Scotland has lost, at a somewhat early age, one of her brightest scientific names, and Great Britain and the world one of the greatest chemists of the present or of any period.

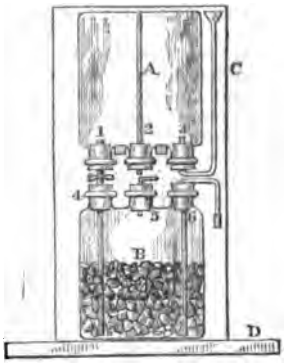
LABORATORY NOTES.

ON A CONVENIENT FORM OF SULPHURETTED HYDROGEN APPARATUS FOR LABORATORY USE.

Of the many forms of apparatus that have been proposed for the generation of sulphuretted hydrogen, very few allow themselves to be changed so as, at a moment's notice, to give a steady and constant stream of the gas without a slight but continuous escape taking place. In large laboratories, where many analyses are being carried on at the same time, and a large amount of the reagent used, the form described by Fresenius in his "Qualitative Analysis," similar to the hydrogen apparatus used in making sulphuric acid chambers, is all that can be desired. Lead, however, is scarcely a suitable material for smaller apparatus, and glass must be substituted. The old form, with three bulbs, is sometimes used, but these are expensive, and objectionable, inasmuch as, when charged, but not in use, the acid is only prevented from falling and acting on the sulphide by the volume of gas below, so that a variation in the temperature, or very slight leak in the connections, or even the porosity of many varieties of india-rubber tubing, is sufficient to keep up a constant action. The form to be described combines, on a small scale, the advantages of both.

In the figure, A and B are two Woulf's bottles, each furnished with three necks, one held over the other b

means of two wooden supports, passing between the necks, and so shaped as to fit the bottle, firmly secured to a backboard, C, which, again, is strongly fixed to the baseboard, D. A may be rendered more secure by further connecting it with the backboard at the top. Each of the necks is fitted with a good cork. A short and rather broad tube is inserted in cork No. 1. No. 4, opposite to it, is furnished with a tube of equal size, reaching to the bottom of B. These tubes are connected by means of a piece of india-rubber tubing, with sufficient space free to allow of the latter being closed by a Mohr's pinch-cock. Through No. 2 passes a small tube, reaching to the top of A and terminating immediately below the cork. In No. 3 is inserted an acid-funnel, the tube reaching on the



inside just above the cork, and bent upwards outside so that the funnel shall be on a level with the top of the apparatus. Through No. 6 passes a tube long enough to reach to the bottom of B: the outside end of this is bent downwards, and terminates in a small piece of india-rubber tubing, which can be plugged with a piece of glass rod. The central neck is furnished with an exit-tube for the gas, the stream from which must be regulated by means of an india-rubber tube and screw-clamp. About one-third of the lower bottle is filled with small pieces of flint, and on this the sulphide of iron is placed.

To charge the apparatus, the tube at No. 6 is closed, and sufficient acid poured down the funnel to cover the sulphide. When the egress of the gas is stopped, the liquid passes up through No. 4 to A, the air in the latter escaping through the small tube at No. 2. When all the liquid has ascended, the connecting tube at No. 4 is closed by means of the pinch-cock, and the lower bottle relieved from the pressure. When the acid becomes exhausted, it may be drawn off by removing the stopper at No. 6, when, if the liquid is in the upper vessel, it will at once run off; if, however, the exhausted solution is in the lower vessel, it must be removed by blowing in at No. 5. The outside limb of No. 6 may be made long enough to act as a syphon, when the necessity of blowing would be avoided: it would then, however, be easily broken.

E. W. PARNELL.

Runcorn, Sept. 25th, 1869.

MISCELLANEOUS.

The Proposed New Chair in the Andersonian Institution.—In our Students' Number we stated that Mr. Young's new chair of technical chemistry had been accepted by Mr. W. H. Perkin; and, as the appointment had received the sanction of the trustees, we were justified in making the announcement. We are, however, now informed that the managers have asked the trustees to cancel the entire arrangement, and we accordingly hasten to notice this fact, especially as the present Professor of Chemistry in the Institution considers our announcement detrimental to his interests. We have received two pamphlets, one being Dr. Penny's remonstrance and appeal against the appointment of an additional Professor of Chemistry, and the other Dr. Adams's reasons of protest; from these we gather that, as Dr. Penny has always instructed his pupils in technical chemistry, and as his income is derived from class-teaching, the new chair would greatly interfere with his interests. Dr. Penny has expressed his willingness to consider any arrangement for carrying out Mr. Young's intentions, provided his titles, rights, &c., are preserved; or, for the actual progress of the Institution, he is willing to vacate his chair on condition of receiving a reasonable compensation for his apparatus and the loss he would sustain. We have no doubt that Mr. Young will adopt some means of carrying out his munificent endowment, without that injury to present interests which it would certainly cause if the original scheme were to be adopted without considerable modifications.

Irrespirable Air of the Wine-Must Fermenting Tubs.—M. Saintpierre.—It is a well-known fact that the four Departments of the South of France, named l'Hérault du Gard, l'Aude, and Pyrénées-Orientales, produce, year after year, about 12,000,000 hectolitres (every hectolitre is rather more than 22 gallons) of wine; every hectolitre of must gives off an average 2500 litres of carbonic acid gas, and, since the size of the fermenting tubs is such that each one contains with ease 400 hectolitres of liquid, one may readily imagine what a quantity of carbonic acid there will be disengaged, considering that, during the short space of from 2 to 3 weeks, from 500 to 1000 hectolitres of must are ready for fermentation in confined localities, generally of no more cubic capacity than 1000 cubic metres (rather more than 35,600 cubic feet). The gas given off during the fermentation has a rather high temperature, and is, moreover, charged with the vapours of various ethers and alcohols, simultaneously the products of the fermentation. Even to those accustomed to this sort of atmosphere its effect upon the system is very marked. Quicklime is very commonly placed in the cellars wherein the fermenting tubs are placed, and a good ventilation kept up. The author of this paper has found, however, that nitrogen is among the products of fermentation; he states that, in 1868, he found that the atmosphere of a large tub could not support the combustion of a candle, although the empty tub (the must and dregs had been removed from it for fully 24 hours before his visit) contained a large quantity of quicklime, and no indication was found of carbonic acid. On analysis of the air contained in this tub it proved to consist, in 100 parts, of:—Oxygen, 11·85; and nitrogen, 88·15. Only the best possible ventilation and plentiful use of lime and lime-water can make cellars wherein these fermenting tubs are placed fit for work-people.—*Journal de Pharmacie et Chimie.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, October 4, 1869.

A great portion of this number is devoted to lengthy discussions upon the manner in which the metrical system has been obtained. Those who have a desire to impugn its accuracy have brought forward several alleged facts relating to inaccuracies committed during the geodesical surveys which preceded the introduction of the *metre*. It is satisfactory, however, to find that these inaccuracies are only imaginary, and the discussions here alluded to fully bring out the important fact, that those who desired to detract from the value of the work of the committee of 1790 are mistaken, even so much so as to confuse works of far later date (1808) with those done in 1789 and 1790.

Artificially-Crystallised Silver Amalgam.—M. E. Dumas.—It appears that at the Mint at Bordeaux (France now keeps up three

mint establishments—one at Paris and one at Strasbourg), there has been left standing, in an iron mercury bottle, a quantity of about 10 kilos. of that metal, which had been used to extract the silver out of some refuse residues. On filtering through chamois leather, there were left upon the filter a certain number of well-defined crystals, which, on analysis, were found to contain, in 100 parts:—Silver, 27·4; quicksilver, 72·6; and traces of gold. The native amalgam of these two metals contains, in 100 parts, silver, 36, and quicksilver, 64, corresponding with the formula $AgHg_2$. The crystals above alluded to correspond to the formula, $AgHg_3$.

Disappearance of the Acids of the Grape and their Probable Conversion into Sugar.—M. Petit.—The author states that the ripening of grapes is accompanied by the disappearance of a large quantity of acid. Green, unripe grapes yield, on an average, 36 grms. of acid to the litre. When the grapes ripen, they double in bulk, and ought, if only water had been added during the process of ripening, to have yielded 18 grms. of acid to the litre, while only from 5 to 6 grms. is detected by analysis. It should be stated that this result is not due to the saturation of the acid by bases, since the ripe grape contains less base than the ripe grape does.

Constitution of Pseudotoluidine.—M. Rosenstiehl.—The author gives the following *resumé* of his paper on this subject:—"I wish to acknowledge an error formerly made, to point out that the constitution of pseudotoluidine is not yet accurately known and well established." Lastly, the author states that he does not intend to pursue studies on this subject any further. The paper is chiefly a critical review of the labours of others on this subject as compared with those of the author.

Cosmos, October 2, 1869.

Manufacturing Manure from Offal of Wool.—M. Pichelin.—Fifty kilos. of this offal are mixed with 33 kilos. of concentrated sulphuric acid and 35 kilos. of nitric acid, sp. gr., 1·321. This mixture is well stirred up for about ten minutes, and next mixed with some native phosphate, coprolites, for instance, in the proportion of 100 kilos. of the acid mixture to 200 kilos. of very finely ground up phosphates. This manure becomes, in forty-eight hours, as hard and dry as rock, so that it has to be ground up again under mill-stones.

Conservation of Wood by Solutions of Salts of Copper.—M. Morin states that he has in his possession wooden water-wheels which have been in use for more than 1500 years for the evacuation of water from a copper mine. These wheels have a diameter of 6 metres; and, on a portion of the wood being analysed by M. Payen, it was found to be perfectly sound, and to be partly converted into a compound of cellulose and copper, precisely similar to that which is formed in Boucherie's process for the preservation of wood by sulphate of copper.

Tanned Cotton, also called cotton-leather, is prepared by treating cotton fabrics in a similar manner to that in which skins and hides are treated for the manufacture of leather. Cotton hereby acquires greater strength, and is more enabled to resist the effects of moisture and disintegrating efforts.

Zeitschrift für Chemie von Beilstein, No. 16, 1869.

We find in this number the following original papers:—

Test for Arsenic and the Preparation of Hydrochloric Acid free from Arsenic.—M. Bettendorff.—When arsenious or arsenic acid is dissolved in fuming hydrochloric acid, and there is added thereto a solution of protochloride of tin dissolved in hydrochloric acid, a brown-coloured very bulky precipitate, which rapidly settles down, is formed, which precipitate, after having been collected on a filter and washed, first with hydrochloric acid, next with water, to remove the latter entirely, constitutes, after having been dried over sulphuric acid *in vacuo*, a greyish coloured powder, of metallic aspect; this, on being rubbed in an agate mortar, exhibits metallic lustre, and is volatile on being heated, while oxide of tin, in the shape of a very light powder, is left. On being analysed, the precipitate was found to consist of from 98·46 to 95·86 per cent of metallic arsenic, according as to its preparation, arsenious acid, arsenic acid, or arseniate of ammonia and magnesia had been applied. The precipitate could never be obtained quite free from tin. The author further states that when the hydrochloric acid employed has a sp. gr. of 1·115, the arsenious or arsenic acids dissolved therein become, if not entirely, at least for the major part, converted into chloride of arsenic; and the reaction described, therefore, takes place between that chloride and protochloride of tin. When the hydrochloric acid has a sp. gr. of 1·100, the arsenious acid is not converted into chloride of arsenic, but is dissolved as arsenious acid; chloride of tin does not act upon combinations of antimony under the same conditions. The author advises that crude hydrochloric acid, sp. gr. 1·164, should, in order to eliminate all arsenic from it, be treated with a strong solution of protochloride of tin in pure HCl, left standing for twenty-four hours, the precipitate removed by filtration, and the acid next placed in a retort, the first 1-10th of the distillate kept separately, and the remainder distilled off to dryness, when that portion will be found absolutely free from arsenic; the first 1-10th might, in some cases, retain 0·02 per cent of that metal.

Orthoxylol, a New Modification of Dimethyl-Benzol.—MM. Bieber and Fittig.—The authors have discovered a new hydrocarbon, C_8H_{10}, which differs from isoxylol and methyl-toluol, and has been named by them *orthoxylol*. It is a fluid body, and boils at 141°; it is distinguished from other substances of isomeric composition by the difficulty wherewith it yields nitro-combinations, and, also, by the slow action which a mixture of chromate of potassa and sulphuric acid exerts upon this substance.

On Bromotoluol, Bromotoluol-Sulpho Acid, and Isomeric Sulpho-Hydrate of Toluol.—MM. Hübner and Wallach.—This rather lengthy paper is not at all suited for any useful abstraction with due justice to the labour of the authors.

Action of Sulphurous Acid upon Chloride of Platinum.—M. Birnbaum.—The author reviews, at some length, the labours of other investigators on this subject, and then states that, when ammonio-chloride of platinum is placed in a concentrated aqueous solution of sulphurous acid, and the mixture heated on a water-bath, care being taken to keep excess of sulphurous acid, a yellow solution is obtained; this solution was evaporated to dryness, again some aqueous SO_4 added to it, and dried over SO_4. A compound was obtained in crystalline state, which contained platinum, ammonium, chlorine, and sulphurous acid—$Pt{:}3Cl{:}SO_3{:}2NH_4$. When the strongly acid solution of ammonio-chloride of platinum in sulphurous acid was saturated with carbonate of potassa, a salt was obtained wherein the different component bodies were contained in the proportion expressed by $Pt{:}3Cl{:}SO_3{:}2NH_4{:}K$. This salt is the potassa salt of the acid first obtained by the action of SO_2 upon ammonio-chloride of platinum in combination at the same time with chloride of ammonium. The formula of the acid just alluded to is—

$$Pt\left\{\begin{matrix}Cl\\HSO_3\end{matrix}\right\}+2NH_4Cl.$$

The author succeeded, by means of a complicated set of experiments, in substituting, for both atoms of chlorine of the chloride of platinum, the radical HSO_3, and thus obtained a crystalline compound—

$$Pt\left\{\begin{matrix}HSO_3\\HSO_3\end{matrix}\right\}+2NH_4Cl+H_2O.$$

No. 17, 1869.

This number contains the following original papers:—

Contribution to our Knowledge of Isomerism in the Benzoic Acid Series.—M. Hübner.—This memoir is a critical review of the labours of M. V. von Richter on the subject above named; and the author defends his own experiments on this subject, and proves that M. V. von Richter has made several mistakes. The paper is not suited for abstraction.

On Arbutine.—M. A. Schiff.—Just in the same manner as salicine can be split up into glycose and saligenin, arbutine is split up into glucose and hydrochinon. The relation between salicine and arbutine may be represented by the following formulæ:—

$$C_6H_7\left\{\begin{matrix}O\\(OH)_4\end{matrix}\right.\qquad C_6H_4\left\{\begin{matrix}O\\CH_2OH\end{matrix}\right.$$

Salicine
Glycosalicyl-alcohol.

$$C_6H_7\left\{\begin{matrix}O\\(OH)_3\end{matrix}\right.\qquad C_6H_4\left\{\begin{matrix}O\\OH\end{matrix}\right.$$

Arbutine
Glycohydrochinon.

Benzoyl-arbutine is prepared by means of chloride of benzoyl; the acetyl-arbutine is prepared by the action either of acetyl-chloride or of acetic anhydride. The final products of these reactions contain five acid radicals, and are made up according to the following formulæ:—

$$C_6H_7\left\{\begin{matrix}O\\(O.C_2H_3O)_4\end{matrix}\right.\qquad C_6H_4\left\{\begin{matrix}O\\O.C_2H_3O\end{matrix}\right.$$

Pentacetylarbutin.

$$C_6H_7\left\{\begin{matrix}O\\(O.C_7H_5O)_4\end{matrix}\right.\qquad C_6H_4\left\{\begin{matrix}O\\O.C_7H_5O\end{matrix}\right.$$

Pentabenzoylarbutin.

These bodies are solid, colourless, insoluble in water, very slightly soluble in ether, and better soluble in hot alcohol; the acid radicals can be removed by boiling with weak bases. The author's paper is full of a series of formulæ similar to those here quoted; he states that an aqueous solution of arbutine reduces freshly precipitated oxide of silver readily at a low temperature. A solution of arbutine yields, with solution of perchloride of iron, a deep blue colouration, which gradually disappears; but the derivatives obtained from arbutine do not do so.

Isomeric Nitrotoluols and Toluidines.—MM. Beilstein and Kuhlberg.—After referring to the experiments made on this subject by M. Rosenstiehl, the authors state that the party just named did not enter into any particulars as regards the splitting up of nitrotoluol into its different components—that is to say, all of them nitrotoluols differing from each other by slightly modified properties, the various bodies being distinguished by the prefixes α, β, and so on. The paper is rather a catalogue of formulæ, and is divided into five sections, treating of the sulpho-acids; toluidines and para-toluidines; aceto-toluides; toluidine derived from xylol; and β chlorotoluol, $C_6H_4Cl.CH_3$. The authors, moreover, state that this paper is intended only as a general survey of the subject, and that they continue their researches thereon.

Isomeric Nitro-Ethyl-Benzol and Xylidine.—MM. Beilstein and Kuhlberg.—α nitro-ethyl-benzol boils at 246°, has a specific gravity of 1·124 at 25°, and is a yellow-coloured fluid; β nitro-ethyl-benzol is also a liquid, boils at 227°, sp. gr. 1·126 at 24°. *The α compound is capable of yielding acids; not so the β compound. Xylidine*, $C_6H_4.C_2H_5.NH_2$, corresponding to the α nitro-toluol, *boils 214°*, is a limpid liquid which becomes readily brown-coloured on exposure to air; sp. gr. 0·975. The β xylidine boils at 210°. Acetoxylide, $C_6H_3.NH(C_2H_3O)$; the α compound boils at 317°, fuses at 94°, and is somewhat soluble in hot water; the β compound is readily soluble in hot water, and boils at 305°; both are solid bodies.

On Dichloric and Trichloric Benzoic Acid.—MM. Beilstein and Kuhlberg.

Derivatives of Benzol obtained from Toluol.—MM. Beilstein and Kuhlberg.—These papers are not well suited for abstraction.

On Paratoluidine.—MM. Hübner and Wallach.—Paratoluidine is a liquid which in pure state resists a cold of −21° without becoming solid, is very readily soluble in alcohol and ether, and rather soluble in water; with acids, it yields salts which crystallise. Sulphate of paratoluidine, $(C_6H_4NH_2.CH_3)2SO_4H_2$, is very readily soluble in water. Acetoparatoluide, $C_6H_4.CH_3.NH.C_2H_3O$, is a solid body exhibiting needle-shaped crystals, fusing at 105°, soluble in alcohol and ether, but not readily soluble in water.

Solubility of Nitrates in Nitric Acid; Separation of the Nitrates of Potassa and Soda from each other.—M. C. Schultz.—Nitric acid does not form acid salts. Several nitrates which are readily soluble in water are difficultly soluble in nitric acid; and this fact explains why silver, lead, and iron are not readily acted upon by very concentrated nitric acid. One part, by weight, of the undermentioned salts require for their solution in—

	The First Hydrate of Nitric Acid, HNO_3.	Hydrated Nitric Acid, $2HNO_3+3H_2O$.	
		(At 20°.)	(At 123°.)
	Parts.	Parts.	Parts.
KNO_3	1·4	3·8	1
$NaNO_3$ ..	66·0	32·0	4
$LiNO_3$ ..	200·0	—	—
$AgNO_3$ ..	500·0	30·0	6

The nitrates of baryta, strontia, and lead are as insoluble in both the above-named nitric acids as the sulphates of these metals are in water. The nitrates of potassa, rubidium, and ammonia are readily soluble in hydrated nitric acid. The author is of opinion that the by far greater solubility of nitrate of soda than nitrate of potassa in nitric acid might be applied to the separation of these salts from each other; but the author very properly observes, also, that working with nitric acid, especially on the large scale, is, in many instances, impracticable. For analytical purposes, this plan is not suitable, since chloride of sodium is rather insoluble in nitric acid.

No. 18, 1869.

This number contains the following original communications:—

Researches on the Sulpho-Acids of Benzol.—M. Ross Garrick.—This paper contains an enumeration of the most prominent salts of the three following acids:—From benzolsulpho acid, C_6H_4Br,SO_2HO; isobromobenzolic acid, $C_6H_4BrSO_2HO$; benzoldisulpho acid—

$$C_6H_4\begin{cases}SO_2HO\\SO_2HO\end{cases}$$

Without reproducing a very lengthy series of formulæ, the chief contents of this paper, we do not find therein anything worth much notice, and therefore abstain from further quotation of its contents.

New Method of Converting Fatty Acids into their Alcohols.—Dr. Saytzeff.—This is simply a preliminary notice, *pour prendre date*, written from Kasan. The author says that, when sodium amalgam is suffered to act upon a mixture of fatty acids and their anhydrous chlorides, the alcohols belonging thereunto are obtained; for instance, acetic acid and acetyl-chloride yield ethylic alcohol. The author promises full and complete details in a future paper.

Formation of Aniline from Bromide of Benzol.—MM. Hübner and Alsberg.—This paper is also marked "preliminary notice." It is written with the object of elucidating the question, Whether the atoms of hydrogen contained in benzol do all occupy the same rank? In order to settle this point, the authors have set to work to obtain, from different bromated and chlorinated benzols, anilines, and to compare these mutually. For this purpose, bromide of benzol was nitrified, with the result that two varieties of bromonitrobenzol were obtained; one of these compounds, evidently, is the same as that described by M. Couper; the other compound is a monobromonitrobenzol, fusing at about 38°, and yielding, on being amidised, two bromoamido compounds. The bromonitrobenzol (Couper's) fuses at 125°, and yields, on being treated with tin and hydrochloric acid, an amido compound, $C_6H_4BrNH_2$; this, on being first treated, while in alcoholic solution, with sodium, and next with chloracetyl, yielded an acetanilide, fusing at about 116°, soluble in water, and more readily soluble in alcohol and ether. The authors promise full details on this subject afterwards.

Thihydrobenzoic Acid.—MM. Hübner and Upman.—A short "preliminary notice." When sulphobenzoic chloride is brought into an apparatus wherein hydrogen gas is briskly evolved from tin and HCl, a white substance is separated, which, on being collected on a filter, washed with water, dissolved in ammonia and re-precipitated by HCl, and boiled in alcohol to which HCl is added, there is obtained a solid crystalline substance, a compound which, on being submitted to elementary analysis, was proved to consist of $C_6H_4.SH.COOH$; this body the authors have named thihydrobenzoic acid; it fuses at 242°, is difficultly soluble in alcohol, and insoluble in water.

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt. First two numbers for 1869.

Of this periodical, published by the Austrian government, one number is published at the end of each quarter of the year. Very frequently these papers contain the results of chemical researches and analyses, and these we briefly abstract:—

Phosphatic Nodules from the Chalk Formation of Russian Podolia.—Dr. Alth.—Leaving the purely geological portion of this paper, and the discussion on the origin of the phosphatic nodules in general, and especially of the variety here alluded to, the author states that the result of the analysis for this mineral is, for 100 parts:—Water, 0·65; silica, 14·18; lime, 26·12; fluorine, 11·69; alumina, 0·99; phosphoric acid, 23·50; iron (*eisen*), put down as metal, 9·23; cobalt, 4·60; manganese, 1·40; sulphuric acid, 2·10; magnesia, 3·52; potassa, 1·20; loss, 0·82.

Analyses of Several Kinds of Common Salt from Galicia.—M. A. von Kripps.—This paper is sub-divided into several sections. The average composition of rock-salt from Stebnik is, in 100 parts:—Chloride of sodium, 90·281; chloride of potassium, a trace; chloride of magnesium, 0·286; chloride of calcium, 0·508; sulphate of lime, 8·245; water, driven off at 160°, 0·680. Rock-salt from Kossow contains, in 100 parts:—Chloride of sodium, 98·0; alumina, 1·7; loss by heat (water driven off at 160°), 0·2. We have only selected a couple of samples from among a number of about one hundred. It appears that Galicia is very well provided with deposits of rock-salt, which is wrought out by mining processes, and that, by boring, saline springs of sufficient strength to admit of boiling down and obtaining salt thereby, are found in large number.

Researches on the Mineral Water of Rajec-Toplitz.—M. E. Glasel.—In a remote portion of the Comitate of Trentschin, near Sillein, a mineral spring is met with, the water of which is the subject of this memoir. The temperature of this water varies from 26·5° R. to 20·4° R. The water is colourless, devoid of smell, has a saline astringent taste, and exhibits, in its natural state, alkaline reaction. In 100 parts, the composition of the dry saline residue is quoted as follows:—Calcium, 52·63; magnesium, 33·29; sodium, 9·21; potassium, 2·83; aluminium, 2·02; oxide of iron, a mere trace; carbonic acid, 82·17; sulphuric acid, 16·57; chlorine, 1·31; silica, 0·80; phosphoric acid and iodine, a trace; free carbonic acid, 7·05; sp. gr., 1·000768.

Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique, No. 7, 1869.

This number contains only one paper relating to chemistry:—

Presence of Chloride of Sodium in the Water and Rocks of the Coal Formation of Luijk (Liège).—M. R. Malherbes.—The paper here quoted is not the original work of the author, but two reports on his paper, one of which is written by the well-known M. Omalius D'Halloy, the other by M. Dewalgue. Both these gentlemen differ from the author above-named, as regards his opinion that the formation of coal should have taken place in salt-water ponds; but they also state that it is difficult to explain why some samples of sandstone of the locality above named should contain 0·101 per cent of chlorine, while in other samples of the same stone, and in the same locality, no chlorine is found at all. Some of the schistose rocks contain 0·085 per cent of chlorine; others, again, none of this element, notwithstanding they are found close by each other and evidently belong to the same geological formation.

Journal de Pharmacie et de Chimie, September, 1869.

This number contains the following original articles:—

Laws which Regulate the Part any Substance Plays between Two Solvents.—MM. Berthelot and Jungfleisch.—A paper on this subject, recording researches of the same nature, was published by these authors, and noted by us from the *Comptes Rendus*, therefore we do not further allude to it here.

Purifying of Bromide of Potassium.—MM. Bobierre and Herbelin.—The authors state that when bromide of potassium is adulterated, or mixed with iodide of potassium, it is, in order to detect this, only necessary to place a few grains of the salt in question on paper previously impregnated with starch paste, to moisten it, and admit a small quantity of chlorine gas, whereby the iodine is set free and the paper coloured blue. A better test, given by the authors, is the use of bromine, added to the salt after it has been placed under benzol; if the latter becomes red-coloured, iodine is present. The title given to this paper should have been "On the Detection of Iodine in Bromide of Sodium."

Preservation of Eggs.—M. Violette.—The main results of this paper are the already long known facts that eggs may be kept in perfectly fresh state by varnishing them over with a so-called drying oil, linseed oil being preferred on account of its cheapness; poppy-seed oil also answers this purpose perfectly well.

Bayerisches Industrie und Gewerbeblatt, July and August, 1869.

These two numbers, published together, contain, among the officially-published material, most excellently drawn-up and well-digested law, and police regulations, for the management and traffic of the railways of the Kingdom of Bavaria. The duties, as well as the rights, of the officials thereby employed, as well as of the travelling public, are clearly and distinctly defined, and every care and precaution is taken to insure the safety and comfort of all concerned. Even in a technical point of view, this document deserves the notice of all who have anything to do with, or authority over, railways, which, as evidenced also in Bavaria, are better managed, and with more profit to the nation at large, by the State than by private companies.

Ceramic Industry of Krünningen, Lower Bavaria.—Dr. Wimmer.—The kingdom of Bavaria is rich in various qualities of

clay fit for the most varied kinds of pottery, from the finest china, made near Nymphenburg, to the coarse but highly refractory clay which is made up in so-called Passau melting pots. The clay referred to in this paper, after having been dried at 100° (whereby it lost 21 per cent of water), gave, on being analysed, the following results for 100 parts:—Water, and trace of organic matter (lost by ignition), 2·02; alumina, 27·42; oxide of iron, and traces of oxide of manganese, 6·88; lime, 5·60; magnesia, 0·20; potassa, 0·18; silica, in combination, 19·20; sand and free silica, 38·40. No traces, even, of sulphuric and phosphoric acids, chlorine, and carbonic acid could be detected. This clay is fit only for very coarse pottery.

Schools for Brewing in Bavaria.—Dr. Zängerle.—It appears from this paper that there exist, at Munich and Augsberg, excellently arranged schools wherein everything which relates to the brewing of beer is taught practically and theoretically; and, from the enumeration of the students who attend, they being natives from various European countries, as well as from America, this instruction seems to be highly valued.

Polytechnisches Journal von Dingler, first number for August, 1869.

This number contains the following original papers relating to chemistry:—

Manner in which the Nitrogenous Substances are Divided in the Potatoes.—M. Dietzel.—This lengthy paper contains researches made by the author with the view to determine what portion of the tuber of the potato is richest in protein compounds; and since, according to this author, there exists a peculiar relation between the quantity of the fatty matter contained in this, as well as in other vegetables, he concludes that, where the largest quantity of fat is there also is relatively the largest quantity of protein. The results are quoted as follows:—The layer nearest the skin contains—Proteinoid, 14·16; fat, 0·66; quantity of proteinoid for one part by weight of fat, 21·45. Interior of tuber contains—Proteinoid, 9·50; fat 0·38; quantity of proteinoid for one part, by weight, 25·00.

Use of a Vacuum in Brewing.—M. Jicinsky.—This paper is so entirely of a practical nature that it is not exactly suited for our pages; but the author certainly proves the great benefits brewers would gain by adopting the use of vacuum apparatus.

Second number for August, 1869.

Among the original papers relating to chemistry, we find in this number:—

Peculiar Steam-Boiler Incrustation.—M. Reichardt.—On visiting a manufactory situated on the higher portion of the Thuringian river Saale, the author noticed a boiler incrustation, which, from its very dark brown colour, appeared almost to consist of an oxide of iron containing manganese. The analysis gave the following results:—Water, driven off at 100°, 2·10 per cent; insoluble in hydrochloric acid, 17·12; soluble therein, 80·78 per cent. Full analysis, in 100 parts:—Water, at 100°, 2·10; white clay and sand, 8·87; oil and pitch, 8·25; sulphate of lime, 1·80; peroxide of iron, 1·20; protoxide of iron, 0·22; carbonate of lime, 68·52; carbonate of magnesia, 9·60. The dark colour is due, not to the oxide of iron, but to the organic matter, oil, and fat, partly decomposed by the high temperature, and converted into a kind of pitch.

Chemical Investigation of Tablettes de Bouillon Russes.—M. Reichardt.—The substance here alluded to is not in commerce in the western parts of Europe, and is manufactured from the meat, not only of cattle, but also that obtained from game, which latter is very plentiful in the less inhabited portions of Poland and Russia. The researches of the author, who obtained the genuine material from a friend of his who resides in Russia, yielded the following results for 100 parts:—Water, at 180° (without any decomposition), 21·7; fatty matter, 0·22; nitrogen, 10·57; ash, 4·75; soluble in alcohol, 38·09 per cent. The author, having purposely compared these meat lozenges (for so they may be called) with Liebig's extract of meat, comes to the conclusion that the extract is superior in every respect, but that this is counterbalanced by the relative cheapness of the lozenges, and their very convenient portability and non-liability to decay.

Neues Jahrbuch für Pharmacie, von Dr. F. Vorwerk, July, 1869.

This number contains the following original communications and papers:—

Researches on those Resins Derived from the Convolvulaceæ, which Act as Drastic Purgatives.—MM. Köhler and Zwicke.—This paper contains an historical review of the discovery and older analysis of *Scammonium jalappa*, and other substances less generally known and now obsolete in Europe, formerly used as physic, and produced by plants belonging to the natural order above named. The chemical researches of the authors are confined to convolvuline and jalapine; the former expressed by the formula $C_{72}H_{50}O_{32}$, the latter by $C_{68}H_{56}O_{32}$. These two substances behave with reagents in the following manner:—

Convolvuline is not soluble in ether, and is precipitated by it from its alcoholic solution; is entirely insoluble in benzol; when evaporated to dryness along with nitric acid, convolvuline becomes violet red-coloured upon the addition of SO_3. The acid solution of convolvuline is precipitated by alum solution. The alcoholic solution of convolvuline is not precipitated by a solution of nitrate of protoxide of mercury. Nitrate of silver produces, in solutions of convolvuline, a pulverulent, non-adhesive precipitate, immediately becoming black-coloured.

Jalapine is perfectly soluble in alcohol and ether; is soluble in benzol, but rather difficultly; but is readily taken up by benzol from its alkaline solutions when these are shaken up with benzol. Jalapine, treated as described, is not coloured at all. Acid solution of jalapine remains quite clear and undisturbed on being treated by alum solution; alcoholic solution of jalapine is precipitated by nitrate of protoxide of mercury, yielding a bulky, caseous precipitate, insoluble, also, on heat being applied. Nitrate of silver produces a bulky, caseous, whitish grey, clotted precipitate in solutions of jalapine, and this precipitate is only slowly changed by the action of the light.

These reactions may serve to distinguish between genuine resin of jalap, and between scammony and its resin.

Description of a Practical Chlorine-Water Apparatus.—Dr. Duflos.—There is added to this paper a woodcut, and, without reproducing it, it is not an easy matter to make this apparatus understood. The chief point is that the pressure of the gas escaping from a mixture of 2 ounces of dry bichromate of potassa, and 11 ounces of commercial hydrochloric acid, is made to saturate, with chlorine gas, 8 lbs. of water, by making the gas to force, by pressure, this quantity of water from one Woulf's bottle into another.

Detection of Wheaten Starch among Arrow-root, and of Wheaten Flour among Starch.—Prof. Boettger.—Take 1 grm. of the material to be tested, put it in a porcelain dish, and add 180 c.c. of distilled water; apply heat, and boil the mixture briskly while stirring continuously and briskly with a glass rod. Any starch which is quite free from gluten—for instance, pure potato starch, or pure arrow-root—will not exhibit, when treated in this way, any foam on the surface of the liquid as soon as the stirring is discontinued; but when the starch happens to contain the slightest trace of gluten, in other words, flour, there will appear on the boiling liquid, during the stirring up, a strong foam, which is so strong that it often resembles the foam on soap-suds.

August, 1869.

This number contains the following original papers:—

Gelatinæ Medicatæ in Lamellis.—Dr. Huseman.—This paper treats on the preparation of a peculiar kind of lozenges, pills, and gelatinous capsules fit to serve as vehicles for either very strong pharmaceutical preparations, which can only be given in very minutely small doses, such as as atropine, strychnine, and the like, or substances which are very disagreeable to the taste, as *balsamus copaivæ*, cod-liver oil, &c. The paper is strictly a pharmaceutico-technical one, and we therefore allude no further to it.

Preparation of Pure Hydrochloric Acid.—Dr. Rieckher.—The author mixes crude hydrochloric acid, sp. gr. 1·170, (containing 34·25 per cent real HCl), and sulphuric acid, sp. gr. 1·830 (containing 93 per cent of monohydrated acid), in the proportion of 100 parts, by weight, of the latter acid and 40 parts of the former (HCl), leaving, after distillation, whereby the HCl is volatilised, a sulphuric acid of 1·650 sp. gr. The loss of HCl in this operation amounts to about 3·5 per cent.

Cultivation of Opium in Germany.—M. Jobst.—This paper is altogether of a botanico-technical nature, treating on the mode and commercial advantages of cultivating the *Papaver somniferum* for the purpose of obtaining opium of good quality, which appears to be perfectly possible in some parts of Southern Germany.

Detection of Alcohol in Chloroform.—M. Blacher.—Add to the suspected chloroform a small piece of caustic potassa, and leave the fluid at rest for a few minutes; then add distilled water, and shake the chloroform therewith. Decant the water, and add a solution of a salt of copper to the aqueous fluid; if a precipitate ensues, the chloroform contains alcohol. Another, and perhaps more reliable, plan to detect alcohol in chloroform is to add to the latter a small piece of quite dry caustic potassa and a piece of reddened litmus-paper; if the latter becomes blue on being shaken up with the chloroform, it is sure to contain alcohol, provided always that it is quite anhydrous.

Revue Hebdomadaire de Chimie, September 16, 1869.

Names Given to Spirituous (Alcoholic) Liquids.—M. Mené.—It frequently happens that some industrial, or commercially-adopted, term for an alcoholic fluid is not properly understood, and this especially is the case with what, in and out of France, is known as *trois six*, 3-6. All alcoholic liquids are designated according to their strength, as indicated by Cartier's areometer for spirituous liquids. Liquids from 16° to 20° are called *eau de vie*, strictly translated water of life, or life-giving. Holland proof is spirit of 19° Cartier, strong *eau de vie*, brandy marks 21° or 22°. Above that degree, the fluids are named *esprits*, *spiritus*, and, by means of certain cypher figures, written as fractions, the greater or smaller quantity of water which these fluids require, in order to be reduced to the state of ordinary *eau de vie* of 19°, is expressed; for instance, *trois six*, 3-6, is an alcohol of 33°, three parts of which, by bulk, produce six parts of *eau de vie*. The *trois sept.*, 3-7, is alcohol at 35°, three volumes of which form seven volumes of *eau de vie* at 19°. The word brandy is, no doubt, a contraction for *brantwein*, meaning, literally, burnt wine, since real genuine brandy is obtained by the distillation of certain wines, not as such fit for beverage.

Les Mondes, September 16, 1869.

Another Successful Artesian Well.—The well-known M. Say, the owner of the most extensive sugar refinery in France, situated on the Boulevard de la Gare, at Paris, has just got completed, at his manufacturing premises, the boring of an artesian well. At 562 metr--

below the surface, a water layer has been reached, yielding 7000 litres of water per minute. The water, which has a temperature of 28° above zero, on reaching the surface rises to a height of between 20 and 30 metres above the end of the bore-hole at surface level. The cost has been 300,000 francs, and the work has been completed within four years, by the successors to the celebrated MM. Mulot, St. Just-Dru.

Comparative Review of the Composition of Milk from Various Mammiferæ.—In 1000 parts of milk, the undermentioned quantities of the following substances are contained in the milk of the animals respectively quoted:—

	Water.	Butter.	Caseine.	Sugar.	Inorganic matter.
Women	889·08	26·66	30·30	43·68	1·30
Cows	864·20	31·30	48·30	47·70	6·00
She Goats	844·90	56·87	35·14	36·91	6·18
Ewes	832·32	51·31	69·78	39·43	7·16
Mares	904·30	24·36	33·35	32·76	5·23
Asses	890·12	18·53	35·65	50·46	5·24
Sows	818·00	60·00	53·00	60·70	8 30

September 30, 1869.

Strengthening and Rendering Woven Tissues Impermeable to Water.—M. Neuman.—A sulphuric acid bath is made containing acid varying in strength from 40° to 66° Beaumé (specific gravities 1·384 and 1·850), and kept at a temperature of 57°. The woven tissues, cotton or linen, are rapidly passed through this bath, being only left in contact with the acid for from ten seconds to two minutes, according to the nature of the tissue, which is immediately after passed through very cold water, and next submitted to a thorough washing process. The effect of the action of the acid is an incipient dissolution, and formation of a varnish-like matter, which, especially after it has been regularly spread over the fabric, and incorporated therewith by hot-pressing and calendering, greatly increases the strength of the fabric, rendering it simultaneously impervious to water.

Annales de Chimie et de Physique, September, 1869.

This number is entirely filled up with a lengthy monograph, which bears the title—

New Researches on Thermo-Chemistry.—M. Berthelot.—We confine our abstraction to the headings of the different parts and sections of this paper. *Endothermic and exothermic reactions*:—Combinations formed with absorption of heat; on double decompositions; formation and decomposition of formic acid; fermentations and constitution of sugar; on compounds which develope heat when becoming decomposed and in nascent state; formation of protoxide of nitrogen and the decomposition of nitrate of ammonia; chemical action of light; on action by contact; on isomeric transformations; on the influence and effects of pressure upon chemical phenomena; changes of temperature produced by the mixing of divers fluids; general principle involved in all chemical reactions. *On pyrogenetic equilibrium*:—Decomposition of organic substances by heat. This memoir will be continued in another number of this periodical.

Journal für Gasbeleuchtung, August, 1869.

Among the original papers contained in this number we notice:—

What is Cheap Gas?—Dr. Schilling.—The contents of this paper, which is written with an evidently large amount of technical and commercial knowledge on this subject, might be very advantageously translated by our excellent contemporary, the *Journal of Gaslighting*. The idea of cheap gas is, indeed, a very relative one, since it is possible, by those well acquainted with all the *minutiæ*, of gas-making, to manufacture gas which, though nominally cheap, may, by want of "durability," and even with a high illuminating power, be very expensive to the consumer.

Photometrical Studies.—M. Elster.—This paper, and the following—

Purification of Coal-Gas—M. Buhe—are excellent treatises on the subjects, but, unfortunately, too lengthy to admit of any useful abstraction. As regards the purification of gas, it is quite clear, from the manner in which this subject has been taken up abroad that it deserves deeper looking into than is generally done at gas-works.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, May, 1869.

This number does not contain any papers at all relating to chemistry or sciences allied thereto.

June, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Preparation of Silicic Acid in Crystalline Shape by the Dry Way.—M. Rose.—The paper is identical with that which appeared on this subject, written by the same author, in the *Berichte der Deutschen Chemischen Gesellschaft*, No. 14, 1869, from which it has been abstracted.

Relation of Chloral and Trichloracetic Acid to the Animal Organism.—Dr. Liebreich.—This paper relates a series of physiological experiments aided by chemical reactions. It appears that hydrate of chloral may become a very useful and safe anæsthetic.

Emission and Absorption of Heat Radiated at Lower Temperatures.—M. Magnus.—The author states—"Different bodies heated to 150° emit, by radiation, different kinds of heat; some bodies only emit one kind of heat. Rock salt belongs to those substances which, if it is quite pure, emit different kinds of heat. The author then enters into discussions on diathermancy, and the power of absorption for certain rays of heat; but the paper is too concisely written to admit of any further useful abstraction.

Moniteur Scientifique, October, 1869.

This number opens with a short paper on—

Artificial Alizarine.—M. Kœchlin.—To this paper is added a set of printed-calico patterns, dyed in five different species of colours, viz., black, puce, scarlet, pink, and violet, respectively produced by the artificial alizarine of Messrs. Meister and Lucius, as made by them at Hoechst, near Frankfort—madder, garancine, alizarine from madder, and purpurine from madder, both sublimed. From the author's paper, it appears that the substance made by the firm just alluded to is neither artificial alizarine nor purpurine, but a new compound, superior to both these substances. Alizarine, indigotine, and luteoline are correlated by the property of being crystallisable by sublimation. Purpurine does not yield solid colours until after it has been sublimed.

Test for Detecting Very Minute Quantities of Iodine.—M. Alfraise.—Take water, 100 grms., starch, 1 grm., nitrite of potassa, 1 grm.; boil this mixture during five minutes, and, after cooling, pour it in a bottle, wherein it keeps for years without deterioration. When required for use, take 10 c.c., add one single drop of hydrochloric acid. Take as much as a pin's head in size of the dry salt to be tested for iodine, place it in a clean porcelain capsule, and add one drop of the test-fluid last mentioned. When no iodine is present, no coloration ensues; but the least trace of iodine gives rise to the formation of a well-defined blue colour. The liquid test-fluid, after addition of HCl, keeps quite well in a properly-stoppered small bottle.

NOTES AND QUERIES.

Carbonic Acid.—Can any of your readers give me some practical information respecting the manufacture of the above by Harrison Blair's process, viz., the passage of common or superheated steam over red-hot limestone enclosed in fire-clay retorts?—CO_2.

Spectrum of Sirius.—In the hydrogen line, F, of the spectrum of Sirius, that line is not exactly coincident with the solar line, F. If, then, this deviation exists in that line, should not the like condition occur with respect to the lines of sodium, iron, &c., which I do not understand Mr. Huggins to state?—W. P.

Magic Lantern Light.—I require a powerful light to show to an audience the microscopic image enlarged upon a white sheet in a darkened room, and would take it kind if any of your readers could tell me—(1) Will the magnesium lamp do (the room is a comparatively small one); (2) whether is Solomon's or Larkin's powder-lamp best; and (3) where can I obtain or hear of Larkin's lamp (mentioned in the CHEMICAL NEWS, vol. xv., p. 323)?—C. HUNTER.

Detection of Artificially-Coloured Red Wine.—Dr. Wittstein.—The author states that he was desirous to try whether the statement of M. Facen that peroxide of manganese has the property of decolorising naturally red-coloured wine, but leaving the colour of artificially red-coloured wines untouched when, after having been simply for some time in contact with the peroxide, it is filtered off from that material again. The author had some genuine good red wine, the produce of his own vineyard, and also experimented upon some samples obtained from wholesale houses; and he found that, after treatment with peroxide of manganese, all these samples lost their red colour; and, according to Facen's statement, there might be assumed that none of these samples of wine were artificially coloured. The author then added to a genuine red wine about 1-25th part of its weight of mallow flowers (Flores Malvæ arboreæ), which are largely used for colouring wine; and, at the same time, the author repeated this experiment with a very faintly straw-yellow-coloured white wine, obtaining thus beautifully red-coloured wines. On shaking these up with peroxide of manganese, the artificially-coloured samples were, however, found as readily decoloured after filtration as the genuine red wines had been; therefore M. Facen's test does not hold good.—*Polytechnisches Centralblatt.*

TO CORRESPONDENTS.

Ferrum.—Send us sample, with full particulars, as we know o several who use it.

Anatta.—You will find particulars for making sympathetic ink in Cooley's "Cyclopædia of Practical Receipts."

BOOKS RECEIVED.

Elements of Chemistry, Theoretical and Practical. By W. A. Miller, M.D., D.C.L., L.L.D., V.P.R.S., &c., fourth edition, with additions. Part III. Organic Chemistry. London: Longmans.

The Ship-Captain's Medical Guide. Compiled by Harry Leach. 3rd Edition. London: Simpkin, Marshall, and Co.

THE CHEMICAL NEWS.

Vol. XX. No. 517.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

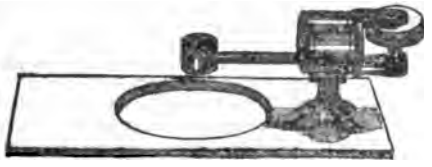
(Continued from p. 182.)

The processes connected with the preparation and preservation of microscopical objects have always occupied a considerable space in nearly every work on the use of the instrument. The subject is one of general interest, and the importance of being able to preserve specimens for future reference can scarcely be overrated.

The simplest of these processes, and also the oldest, is that known as "dry-mounting."

The objects suitable for mounting dry are those which can be preserved in air and are capable of being dried without injury to their structure. The ways of mounting are extremely numerous, and are principally means of protection from the great enemies of all natural history preparations—damp and dust. One of the oldest ways of mounting objects was upon discs punched from a compound sheet of card and wash-leather, through which a pin was run for convenience of holding in the stage forceps and keeping in a cork-bottomed drawer. This plan of mounting was abandoned when the lieberkuhn fell into disuse, but it has since been revived in a new form by the late Richard Beck, who invented a very ingenious instrument for holding the small

Fig. 17.†



discs of metal and turning them into any required position. This is an extremely useful piece of apparatus, as it is often required to turn an object into several positions for the thorough examination of its structure. So perfectly is this accomplished, that five out of the six sides of a cube may be examined by means of the revolving disc-holder. This instrument has supplied a want created by the introduction of the binocular microscope, as the greater focal depth and stereoscopic effect given by it has rendered advantageous frequent changes of the position of objects, for which this contrivance most effectually provides. For the keeping of the discs from the influence of dust and damp, he contrived a close-fitting screw-box, having suitable arrangements for the reception of twenty-four discs.

Great use has also been made by some observers of open cells. These consist of a hole bored in a 3×1 slide of wood, with a piece of card-board glued to the bottom, the objects being fastened with a little gum. This answers very well with objects not liable to injury from exposure, such as shells; but, for most purposes, it is necessary to close up the object, and this, in many instances, is done in a manner very detrimental to its preservation. Wherever paper and paste or gum are used, various fungi and confervæ are nearly sure to make their appearance, unless special precautions, such as saturating the paper with, and mixing in the gum, a small quantity of corrosive sublimate. The microscopical fungi are doubtless interesting plants, but, when they grow over valuable preparations, we feel them to be a nuisance, and decidedly in the way.

Some microscopists, avoiding the use of paste, gum, and paper for securing the cover to the slide, have made use of varnishes of several kinds These generally have the defect, if thin, of running in between the glass and cover and spoiling the object, and, if thickened with a solid substance, such as lamp-black or vermillion, of becoming porous after a time. Some of the fluid medium of the varnish, also, is liable, in drying, to rise in vapour within the cell, and condense on the cover, interfering with the distinct view of the object. The vapour of turpentine or naphtha, however, is in no way otherwise detrimental, as it tends rather to the preservation than the destruction of tissues.

The electrical cement previously described (Chemical News, vol. xx., p. 181) is free from this defect, and furnishes a means of rapidly mounting objects either with or without a cell. If the object is very thin and flat, it may be placed upon a slide, and a thin glass cover put over it. Both having been carefully cleaned, one of the spring clips made of wire and cork (which are to be procured of most opticians) can be used to hold the cover in place while the cement is being run round it with the little brass bit. The bit should not be made too hot, or it will not hold the cement. After the cover has been fastened down, the rough cement can be smoothed by passing over it a clean bit, heated rather more than is required for laying on the cement. The bit is easily cleaned by wiping while hot upon a piece of blotting-paper. The first attempts, no doubt, will be far from elegant in appearance; but, after a little practice, great neatness may be attained. This process is also available for attaching the cover to cells of metal or glass, which must be used with dry-mounted objects whenever their thickness is such as to require it. This mode was formerly much employed, but was abandoned on account of the brittleness of the cement. This may be remedied by varnishing, when the cement has become hard, with gold-size, which is remarkable for the tenacity with which it adheres to glass and its toughness and non-liability to crack. Respecting the properties of this varnish, more will be said in the chapters relating to fluid-mounting. This system of compound cementing answers perfectly; the electrical cement having, in the first instance, no tendency to run in, and the gold-size effectually keeping it from separating from the glass. If the natural red colour of the electrical cement is objected to, a black finish can best be obtained by the use of lamp-black as prepared for water-colour painting. The best form is that in tubes. A little of this is pressed from the tube, and, if too thick, a small quantity of water added. With this the varnished surface is thickly painted, and, when dry, a few coats of gold-size will

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

† This, with several other woodcuts, have been kindly lent by Messrs. R. and J. Beck, of Cornhill.

keep it from being washed off. The result is a dense, lustrous black, very superior in effect and durability to that produced by a black varnish. This finish is equally available for fluid and balsam mountings.

If the object cannot be kept in its place by the pressure of the cover glass, it will require fastening. If the object will bear a slight amount of heat, a small spot of electrical cement may be placed on the glass, melted by holding over a lamp, and, while soft, the object fixed. Or the thick varnish composed of shellac and wood-naphtha, sold at most varnish-shops as liquid glue or "patent knotting varnish," will be found useful for this and other purposes to be mentioned hereafter. Care must be taken to allow the naphtha time to evaporate, or its vapour will obscure the cover. While this drying is taking place, the slide may be turned face downwards over a large pill-box, or the cover put on, and kept in place with a spot or two of electrical cement, deferring the completion until the varnish has dried.

It is not necessary to employ any kind of black background for opaque objects, the best background being that of the dark-well beneath the stage, formed by bringing round that part of the diaphragm-plate which has no hole, and so closing up the aperture. If a black patch is used, it prevents advantage being taken of various kinds of illumination from beneath, which are often of great service, while the mounting on clear glass is in no way detrimental to the view of an object lighted from above.

It is necessary that the object to be mounted should be perfectly dry before it is placed in the cell, otherwise moisture will, sooner or later, make itself apparent.

Most objects can be dried by the application of a moderate heat. If wrapped up in a piece of paper, and placed inside the fender, in an hour or so they will be found to be effectually dried. A Seidlitz-powder box answers extremely well for this kind of drying: it can be still more effectually accomplished by means of the well-known hot-water oven.

There are cases, however, where heat is inadmissible, especially with delicate tissues. The desiccation of these is best accomplished in a vacuum. The substance to be dried is placed under the receiver of an air-pump; the air is exhausted, and, under these conditions, it will give off vapour at a much lower temperature than under ordinary atmospheric pressure. It is only necessary to provide some means of absorbing the watery vapour as fast as it is given off—such as concentrated sulphuric acid or dry lime.

Another, and very effectual mode of drying delicate tissues without heat, is the process described in the CHEMICAL NEWS (vol. xiii., p. 122), translated from *Zeitsch. fur Anal. Chemie.* This process, which is quite new so far as its application to microscopical purposes is concerned, consists in immersing the substance to be dried in ether in the presence of dry chloride of calcium. The apparatus employed is simple, consisting of a wide-mouthed stoppered-bottle, at the bottom of which is placed some chloride of calcium. A slice from the bowl of a tobacco-pipe forms a support for a Berlin crucible and cover, in which the substance to be dried is placed. The whole is then covered with ether (the methylated answers very well for the purpose), and the mouth of the bottle closed. The ether absorbs water from the tissue, which is again absorbed by the chloride of calcium, and the process goes on without attention until the chloride of calcium ceases to absorb. The results, as far as at present ascertained, have been very satisfactory. Cellular tissue (fresh potatoe) has been dried without any contraction. Flies' heads have contracted less than by drying in air; the eyes were in very perfect condition, and gave good results upon a section being cut; the striation on the muscular fibre was perfectly preserved. A small spider, treated by this process, was dried without any shrinking of the abdomen. Those substances which are injuriously acted upon by ether cannot, of course, be dried by this process; but it is evidently a very valuable addition to the microscopist's resources.

When the object is removed from the drying apparatus, the ether dries off in a few seconds. If it is required to preserve the object in balsam, it can either be mounted at once, wet, with ether, or transferred to benzole or turpentine.

(To be continued.)

A NEW AND ECONOMICAL METHOD

FOR EFFECTING THE

EXTRICATION AND CONDENSATION OF AMMONIA FROM GAS LIQUOR

FOR PURPOSES OF CHEAP CARRIAGE, AND FOR FACILITATING THE MANUFACTURE OF AMMONIACAL SALTS.*

By FREDERICK BRABY, F.G.S.

(Concluded from p. 184).

The principles already indicated may, perhaps, be illustrated with advantage by a brief description of a working-plant actually constructed at Deptford for the purpose of extracting ammonia. An excavation has been made in which is sunk a reservoir for containing the gas liquor, and having the following dimensions:—namely, 35 feet long, 7 feet wide, and 6 feet deep. The bottom is formed of 1 foot of concrete, two courses of bricks, and of two courses of red flat tiles; the sides are of 14-inch brick-work, two courses with tiles in conjunction with concrete.

The wrought-iron still is set in brick-work, so that flame may play more than half round its external surface. It is 30 feet long by 6 feet in diameter. About 4000 gallons of gas liquor are pumped into it from the reservoir for the purpose of being operated upon.

Heat is applied by means of a fire underneath, but a coil of hot air or steam pipes placed in the interior of the still or boiler would be equally efficacious. Two cast-iron 3-inch air-pipes, which are attached to the ammonia generator, extend along its whole length, and are situated one on either side, and nearly at the bottom. They are perforated with holes increasing in size as they extend from the inlet. Into these pipes, and from them into the gas liquor, is driven atmospheric air by means of a pair of cast-iron force-pumps. These are 20 inches in diameter, 1 foot 8 inches stroke, with rods and slings, wrought-iron connecting rod and crank, and a cast-iron beam 6 feet long. On the entry of the streams of air they are caught and agitated by the twelve iron fans of a stirrer, making about 80 revolutions per minute.

The air, together with the lime and the various constituents of the gas liquor (viz., water, ammonia, carbonic dioxide, sulphuretted hydrogen, sulpho-cyanides, &c.) are thus brought continuously into intimate contact. The air loaded with the volatile alkali which has become eliminated from the solution passes upwards into the steam chest and through a branch pipe into the purifier or washer. This is a small wooden vessel of the capacity of 350 gallons, containing lime and being about one-third full

* Read before the British Association, Exeter meeting, Section B.

of water. It has a tight head and a stout perforated elm false bottom, the holes being concentric and increasing in number and dimension as they radiate from the inlet, which is brought below the false bottom.

This purifying vessel is furnished with a small agitator having two blades, one revolving above and the other below the false bottom. There are two trial or test taps at appropriate heights, to test for gas or for water, and there is also a pipe sealed at one end, rather less than half way from the bottom, for the purpose of leading away any excess of liquid that may accumulate owing to the condensation of aqueous vapour which may pass over with the volatile alkali. There is a long straight tube or safety pipe from the washer, and the bent pipe from the ammonia generator is also provided with a safety valve and a vacuum valve. In the washer the ammonia is deprived of any remaining hydrosulphuric acid or other impurity that may have escaped being fixed in the generator. About half a bushel of finely sifted slaked chalk lime is found to be a suitable charge for the washer, and when this becomes saturated or impure, it is renewed by means of a pipe and tap placed at the bottom of the vessel. The washer being a close vessel soon becomes full of air and gas, which are forced by the pressure through a pipe opening into the top and leading to a coil or worm placed in a cold water cistern, and terminating in a deep close vessel about one-third full of pure cold water, which has been condensed from the waste steam from the engine. A portion of the ammonia becomes absorbed by the water, but the residue, together with all the air, after bubbling up through the liquid, is conducted by a bent pipe to nearly the bottom of a second similar receiver, and thence in the same way to a third, but which is opened at the top,

The air, having fulfilled its function, is now permitted to escape into the atmosphere, the whole of the ammonia having, however, been arrested.

This last receiver, instead of water, contains a strong solution of chloride of iron, which being denser and possessing a higher specific gravity than water, offers a greater pressure and resistance to the passage of the gas. The iron salt is, of course, decomposed, with formation of muriate of ammonia in solution, with deposition of a green mud containing sesquioxide of iron, which, after having been calcined, is found to constitute an excellent pigment for rough iron or wood-work.

After the whole of the ammonia has been extracted from the gas liquor, the contents of the still are run off into a draining pit, from which the clear solution finds its way into the sewers, and the solid inodorous lime compounds may be carted away.

This draining pit is constructed of 1¼ inch deal boards together with sand and brick-work. It is 4 feet 9 inches wide, 5 feet 4 inches deep, and 10 feet long. There are fillets whereon to rest three perforated shelves or platforms. The bottom is formed of perforated deals with 6 inches of sand, also with gravel, and cement. There are channels and small drain pipes leading into a large central earthenware pipe, and from thence into the sewer. The sharp sand, &c., under the perforated boards can be removed at will, and be replaced by fresh materials whenever required.

Care must be taken that the large pipe from the boiler to the washer be sufficiently high to guard against any back pressure. The vacuum valve opens and admits air when the fire of the still is withdrawn and the steam becomes condensed.

In order to ascertain the exact state of the contents of the boiler at any required height, and to avoid tapping the upper portion of the boiler at too many places, the following simple contrivance is adopted:—There is one tap at the lower end, to which is attached a short pipe inside the still working easily on an elbow. To this pipe is connected a copper wire having its outlet just above the external surface of the boiler, and by which wire the short pipe may have its orifice presented at any required height, at which it is desired to ascertain the state of the contents of the vessel. For instance, supposing the fire to be withdrawn, and the agitators to be quiescent, if the end of the tube were pulled up by the wire and the tap opened, a clear liquid would issue, which could be tested in order to ascertain whether the whole of the ammoniacal gas had been removed. On the other hand, if the short tube were allowed to lay along the bottom of the still, the opened cock would allow the green sulphocalcareous mud to escape. It is stated in Dr. Miller's "Elements of Chemistry" that, at a temperature of 32°, water takes up about 1050 times its volume of ammonia; at 59°, 727 times, and at 78°, 586 times its volume. Water saturated with ammonia at 60° contains more than one-third of its weight of the gas, increasing in bulk from 1·0 to 1·5, and becoming specifically lighter.

Hence the receiver should be not more than one-third or one-half full of water to allow for the increase in bulk caused by the solution of the ammonia.

In July, 1867, valuable papers upon the utilisation of the waste products of the manufacture of coal gas were read before that important body, the British Association of Gas Managers, by two of our first authorities on this subject, Dr. Letheby and W. Esson, Esq. Dr. Letheby declares that it is so manifestly of the greatest importance that the liquor should be sent away to the gas works as strong as possible; it ought, in fact, never to be under 6° Twaddle, or of less than 12 ounces strength, and with proper condensation and judicious washing there should be from 29 to 30 gallons of such liquor produced from every ton of coals. The price in London is 2s. per butt, 8-oz., with an increase of 4d. per oz. on every additional ounce of acid strength. Below 3° of Twaddle or 5 ounces of acid it does not pay for working, whereas at 10° or 11° of Twaddle it is a valuable product. Both Dr. Letheby and Mr. Esson emphatically insist upon the importance of the strength of the ammoniacal liquor. So rapidly does the commercial value augment, in relation to its concentration that, whereas a butt of 108 gallons of gas liquor is worth 4s., the same quantity of caustic ammonia of specific gravity 0·900 is worth from £15 to £20. A lower strength of gas liquor than 6-ounce has not hitherto been thought worth working, but one advantage in Braby's system of extraction and concentration consists in the fact that a high strength is not indispensable. Even 2 ounces would in practice yield a profit.

As an evidence of the importance of an increased supply of ammonia and of its large demand, it may be mentioned that a firm with which the writer is connected recently offered 4s. per butt of 6-ounce liquor, and yet was unable to obtain a supply, showing that the value has doubled in the short space of two years. Mr. Esson describes an economical arrangement for the extraction of ammonia from gas liquor with the assistance of steam, and by an apparatus similar to a Coffey's still, but which is subject to the disadvantage that the noxious gas (sulphuretted hydrogen) is not simultaneously fixed or disposed of, and that at least 15 per cent of ammonia is left in the liquor, which has afterwards to undergo the supplementary process of distillation with lime. The present ordinary method of making liquor ammonia is, as far as I am acquainted, from sulphate or muriate of ammonia, which is itself obtained from gas water. By Braby's process, liquor ammonia may be obtained much more quickly and economically from gas-liquor direct.

There are many gas-works where ammoniacal salts are now manufactured; but it is suggested that, in new works, or at those where the gas-liquor is not at present utilised, it would be preferable, in the event of the adoption of the principle herein advocated, that the ammonia, after concentration, should be sent to the sulphuric or muriatic acid works, rather than that the acids should be sent to the gas-works. In metallurgy, it is found more advantageous to transport the calcined or partly-prepared ores to the coal districts for smelting, rather than to take the fuel to the mines.

Barges fitted with tanks ordinarily employed in the conveyance of gas-liquor contain from 3000 to 8000

gallons. A land journey of 12 miles with two horses for a load of 500 gallons in a tank-van now costs £1. By rail, the cost of freight is 1d. per ton per mile.

The advantages of the above-described system may be summed up as effecting a considerable economy in labour, time, and occupation of plant, together with the facility of extracting the whole of the ammonia from the gas-liquor in a pure condition. A manufactory, previously consuming 10,000 gallons of gas-liquor per week, may now utilise 24,000 gallons, and at about half the expense of fuel of that formerly incurred.

The great interest of this subject in a chemical point of view, its high importance to the metallurgist and manufacturer, and the increasing value of ammonia to the farmer (with whom it is almost another name for fertility and abundance), must constitute my apology for having engaged so much valuable time in its consideration.

A CHEMICAL METHOD OF TREATING THE EXCRETA OF TOWNS.*

By EDWARD C. C. STANFORD, F.C.S.

THIS paper is intended as a continuation of two former papers read before the Glasgow Philosophical Society, and published together in the CHEMICAL NEWS, under the title of "A Chemist's View of the Sewage Question."

In these papers, I have endeavoured to show that the water-closet system of disposing of human excreta, unless it undergoes some great modification, can never be regarded as the perfect system of the future. I have strongly urged the general adoption of the dry-closet, as avoiding all the great evils which are apparently inseparable from the use of water as a vehicle; and pointed out the use of charcoal, by which its application to towns and cities is simple and easy. Since these papers were published, further experiments have been made, which strongly confirm the opinions already advanced, and form the subject of this paper.

Amongst other objections to the use of water as a carrier, I have specified—

1. The enormous cost of the works required, in proportion to the small amount of noxious material to be removed.

2. The large annual outlay required to keep the closets in order. Experience, in large cities, has shown that, on this account, these closets are quite unsuitable for the dwellings of the poor.

3. The enormous amount of water employed (estimated at 365 times the weight of the excreta), where, as in many towns, there is much difficulty in obtaining it.

4. That it results in a subterranean flood of filthy water, which must flow somewhere; and, wherever it flows, it pollutes the region, thus disseminating and distributing the evil.

5. This material, worth about 30s. per ton, has its value reduced, by dilution, to 1d. per ton, which it is impossible, by any known chemical method, to extract with profit.

6. The large generation of noxious gases in the sewers, which constantly escape into our streets and houses.

In reference to the latter, Dr. Gairdner speaks strongly of almost all sewers, as "diffusing poison upwards and downwards," and too often "carrying backwards, into the very heart of the dwelling, the reflux gases, the produce of the decomposition of the impurities of a whole neighbourhood."

Dr. Fergus characterises the sewers as "a gigantic laboratory under our dwellings," from which noxious gases escape, by gully holes into our streets and pipes into our houses.

He has furnished me with a number of extracts from eminent medical authorities, which conclusively show the highly dangerous character of the miasma occasioned by the infiltration of sewage water and the evolution of sewer gas.

Of these I shall only make two quotations, which should be sufficient to convince any one of the important bearing of this question on the national health:—

EXTRACT No. I.

Mr. SIMMS'S *Second Report* (1860) *of* Dr. GREENHORN'S *Investigations in Several Towns in England.*

Pages 59 and 60.—"*Diarrhœal diseases* are increasing in this country; they vary, in different districts, from 4 to 663 per 100,000 persons. If the diarrhœal death-rate of England generally were only ten times the minimum diarrhœal death-rate, there would be an annual saving in England of nearly 20,000 lives."

"In the districts which suffer the high diarrhœal death-rates, the population either breathes or drinks a large amount of putrefying animal refuse."

Page 61.—"If the diarrhœal death-rate of England is reduced to that which prevails among the healthier parts of the population, typhoid fever (now, probably, the cause of at least 15,000 annual deaths) will be reduced in more than equal measure; and in proportion as infantile diarrhœa is reduced, the convulsive disorders and respiratory inflammations of infancy (which now cause fully 60,000 annual deaths) will also show a large, if not equal, reduction of death-rate."

Page 64.—"The excess of mortality has, in all cases, been coincident with one or other of two local circumstances—(*a*). *The tainting of the atmosphere with the products of organic decomposition, especially of human excrement*; or (*b*), *the habitual drinking of impure water.*"

EXTRACT No. II.

From Mr. SIMON'S *Ninth Report to the Privy Council.*

Pages 32, 33, and 34.—"*Cholera* derives all its epidemic destructiveness from filth, and especially from excremental uncleanliness."

"It cannot be too distinctly understood that the person who contracts cholera in this country is, *ipso facto*, demonstrated with almost absolute certainty to have been exposed to excremental pollution; that what gave him cholera was, mediately or immediately, cholera contagion discharged from another's bowels; that, in short, this diffusion of cholera among us depends entirely on the numberless filthy facilities which are let exist, and especially in our larger towns, for the fouling of earth, and air, and water, and thus, secondarily, for the infection of man with whatever contagion may be contained in the miscellaneous outflowings of the population. Excrement sodden earth, excrement reeking air, excrement tainted water; these are, for us, the causes of cholera. Cholera ravaging here at long intervals is not Nature's only retribution for our neglect in such matters as are in question. *Typhoid fever and much endemic diarrhœa are, as I have often reported, incessant witnesses to the same deleterious influence. Typhoid fever, which annually kills some 15,000 to 20,000 of our population; and diarrhœa, which kills many thousands besides.*"

Dr. Fergus has drawn attention to a remarkable but very common and fruitful cause of the escape of sewer gas into houses. He frequently noticed, when attending patients suffering from gastric fever, a peculiarly sickly and offensive odour, and in all cases traced it to the leaden syphons and soil-pipes of the water-closet. On examination, these were generally found to be perforated with holes, sometimes of considerable size, through which the sewer gases freely escaped into the house. The evil exists to an extent which will scarcely be credited by those who have not specially investigated the subject. A long length of soil-pipe will often be found bulged outwards in little swellings, each of which, sooner or later, open, and present apertures for the escape of sewer gas.

* Read before the British Association, Exeter Meeting, Section B.

If the pipe be laid, as it often is, under a bed-room floor, this may go on for years, until at last the pipe is taken up in a perfect honeycomb of deterioration; and we may pretty safely predict the sanitary condition of that bed-room and of its occupants. I have been informed by plumbers that it occurs most quickly where chloride of lime has been used; but the necessity for the use of this shows that the evil had existed before its application. The pipe becomes covered in the interior with a whitish-brown powder, of which four specimens were examined; the composition is shown below:—

	I.	II.	III.	IV.
Carbonate of lead	2·70	86·00	91·00	92·90
Carbonate of lime	80·63	2·50	2·10	2·90
Water	0·45	1·20	1·00	0·50
Lead insoluble as oxide ..	—	3·50	1·50	1·45
Silica	1·35	2·80	1·00	1·60
Organic matter	14·87	4·00	3·40	0·65
	100·00	100·00	100·00	100·00

The lead put down as insoluble is combined, apparently, with a kind of fatty acid, represented as organic matter. In No. 1, chloride of lime has evidently been recently used. The pipes are all taken from different closets, and arranged in an increasing order of deterioration. The action is probably caused by the carbonic acid, aided by the other gases of decomposition, and the fatty matter of the excreta producing carbonate of lead under somewhat similar conditions to those which obtain in its manufacture on the large scale; the carbonate of lime being derived from the solid excreta. This view requires confirmation; but one fact is obvious (and it is sufficient to show that the water-closet has been introduced before we have studied its effects)—that leaden pipes so much condemned for carriage of water for drinking purposes are even more unsuitable for house drainage; and the reason given explains, to a certain extent, what is generally admitted—that the common earthenware syphon forms the cleanest water-closet.

None of the disadvantages enumerated attend the use of the dry-closet; still less can any of these gigantic malaria evils result from its general adoption. It meets every sanitary requirement, which, after all, is the main desideratum. Moreover, its machinery is simple and inexpensive. It effects at once a great saving of water; and it enables us to secure the whole of the value of the excreta. I have pointed out the only objections which can be urged against its application in large cities to be, when dry earth is used; the large amount required (three and a half times the weight of the excreta), the difficulty of obtaining such a supply, and the large cartage necessary: three and a half times the weight to be removed into the city, and four and a half times the weight to be carried out.

Now, by using charcoal, these objections are entirely removed; for it only requires one-fourth the quantity as compared to earth, and, by re-burning the charcoal, the supply is provided from the excreta itself; and the cartage is reduced to the weight of the material carried into the city, and twice its weight carried out. The quantity per diem for a population of 500,000 is calculated at 385 tons in, and 770 tons out; a quantity about the same in Glasgow as the city ashes.

Moreover, charcoal has other advantages over earth. It is a powerful deodoriser, and its employment guarantees a perfect immunity from odour quite unattainable by any water-closet; and it blackens and conceals the excreta so perfectly that no one seeing the product from the closets for the first time would have the least notion from its appearance what it was. As, also, the dust would always be sifted out for sale as manure, the charcoal used in the closets would always be of proper size, and no dust could be projected in the working of the closet. Such a closet could be kept in every bed-room without the possibility of becoming a nuisance, if only attended to; but, in houses constructed for the purposes, the closets on the several floors would be over one another, and the product from each fall through a 12-inch pipe to a small cesspit below the house, and this need only be emptied once a year. The small size of this pit may be imagined when it is mentioned that 1 cwt. of charcoal per month will be sufficient for each closet if used by six persons daily, and one cart load per annum will empty the pit.

Use of Charcoal in Latrines.—I have shown, in a former paper, how the use of seaweed charcoal in latrines effects its composition, by converting the carbonate of lime it contains into phosphate. The results published were from experiments with ten, twenty, fifty, and one hundred times its weight of urine evaporated down. I found that, though in all cases there appeared to be no appreciable loss of ammonia in drying, when the last product was re-burned alone, only half the nitrogen came over as ammonia, though the whole was obtained by soda lime. As, however, I propose for latrines the charcoal should be used ten times before re-burning, I have undertaken a complete series of experiments, the results of which are given in Tables A, B, and C, showing the composition of the chars after each re-burning, up to ten re-burnings and one hundred uses. The results are as regular as can be expected from the variable composition of the substance operated on. It will be seen that the residual chars rise, after five or six re-burnings, to about 25 per cent phosphate of lime, while the carbonate is reduced to 2 per cent. After having attained this composition at which it becomes regular, it would be advisable to add a certain proportion of fresh seaweed char, to prevent the phosphoric acid remaining soluble, of which a trace now appears, and to secure a regular supply of a good sugar-refiners' charcoal, which would add a considerable value to it. In any case, the phosphate of lime thus gradually deposited is quite equal to a soluble phosphate for agriculture on account of its finely divided condition. The average yield of ammonia by simple re-burning is about equal to the calculated amount, and shows clearly that neither in the drying nor in the distillation has any been lost. The total yield is 316 per cent on the char, or 31·6 per cent for each re-burning. The total increase of char is 183 per cent, or 18·3 per cent for each re-burning.

The density of the char has increased 131 per cent in the ten re-burnings, the increase being mostly in the first five re-burnings. The ammonia only was estimated in the destructive distillation. The increments of potash and phosphoric acid are pretty regular, that of sulphuric acid remarkably irregular. The commercial result of this process for latrines would be as follows:—Supposing the char sold as a manure after ten uses, 1 ton would produce, allowing 15 per cent for moisture, 30 cwts. of manure, containing nitrogen equal to 20 per cent sulphate ammonia, 7 per cent phosphate lime, and 5 per cent sulphate potash, and worth at least £5 per ton, or equal £7 10s., whilst it would have cost £2 for the char, 30s. for cartage, reckoned at 10 tons carted in and 20 tons carted out at 1s. per ton, or a profit of 8os. on each ton of char used. If, again, the char be used fifty times, and re-burned five times, its cost will be increased by cartage to £9 10s., and, by five re-burnings at 3s. 6d., to £10 7s. 6d., and in quantity, allowing 11 per cent for moisture, to 2 tons, the cost being thus £5 3s. 9d. per ton, and its value, containing 12 per cent phosphate lime, reckoned as soluble, and 15 per cent sulphate of potash, is £5 per ton, in addition to which nearly 30 cwts. of sulphate of ammonia are yielded in the five re-burnings, worth, at 16s. per cwt., the sum of £24 less the cost of acid. If, however, the char be as good a sugar refiner as I suppose, its value will be much above that stated. In this case, however, the char would have to be washed, and the amount would be less by the amount of soluble matter it contains from which the potash could be separated. It would be easy, of course, to increase the soluble phosphate for some crops by the addition of mineral phosphate rendered soluble.

Use of Charcoal in Closets.—The experiments, the results of which are given in Tables D and E, were made with one of Smith's self-acting dry-closets, used by several lads.

No. 1 was distilled wet, Nos. 2 and 3 dry. After this, the charges were dried, and returned to the closet, and used again before being re-burnt. Nos. 8, 9, and 10 are complete analyses; and what is deficient in the others is calculated from these. A portion of the ammonia comes over combined with acetic acid, which is separately shown, and also the acetic acid as acetate of lime. The average results per deposit and per cent of wet and dry excreta are also shown. The composition of several of the resulting chars, and the increase per cent of the several ingredients, are shown in Table E. After No. 3, the compositions are pretty similar; and this may be taken, therefore, to be the char from excreta. The char commenced with was only 3 lbs., or 48 ozs., to which 18 ozs. were afterwards added, the total amount employed being 66 ozs. At the end of the experiment, it amounted to 123 ozs., 57 ozs. being derived from the excreta; and yet this small original stock served 181 uses of the closet and absorbed 808 ozs. of wet excreta, having been dried and re-used seventeen times, and re-burnt ten times. It increased about 66 per cent in density, then remaining constant, but was in every respect better adapted for the closet, and improved by the treatment, the charge being still under 8 ozs. at the end of the experiment. The distillation yielded over 38 ozs. of sulphate of ammonia, or nearly 7 per cent of the wet excreta. I propose that the mixture should be dried and re-used five times before being re-burnt: this has not been done in these experiments, as I was impatient for results. Where this is done, a considerable quantity of gas is given off in the distillation, and, from the large amount of fatty matter, it possesses considerable illuminating power. This fatty

TABLE A.

Residual Chars.—Composition per cent.

	Ordinary Char.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Water	10·00	—	—	—	—	—	—	—	—	—	—
Soluble salts	0·60	9·00	17·60	27·00	36·20	41·80	49·20	51·20	54·80	56·80	59·20
Insoluble	89·40	91·00	82·40	73·00	63·80	58·20	50·80	48·80	45·20	43·20	40·80
Soluble.											
Chlorine =	—	4·87	8·56	13·32	16·80	19·32	23·31	26·46	28·56	29·40	31·08
Chloride of sodium	—	8·11	14·26	22·17	28·00	32·20	38·83	44·00	47·60	49·00	51·80
Sulphuric acid	0·30	0·51	1·02	1·37	3·50	3·70	4·11	2·00	2·05	2·22	0·68
Phosphoric acid	—	—	—	—	—	—	—	—	trace	trace	trace
Potash	0·30	2·30	4·20	4·60	7·69	8·07	10·76	10·96	11·15	11·73	12·40
Insoluble.											
Carbon	54·40	40·00	40·60	35·80	32·20	33·20	26·20	26·00	23·40	23·40	23·40
Silica	9·10	12·40	12·40	11·20	8·80	6·20	6·20	5·60	5·20	4·40	3·20
Phosphate of lime	4·80	6·60	8·40	10·20	11·60	12·00	12·20	11·60	11·40	10·40	10·50
Carbonate of lime	17·40	24·20	15·60	11·60	7·40	3·60	2·80	1·20	0·40	0·40	0·90
Carbonate of magnesia	3·10	5·80	4·40	3·00	3·00	3·00	2·40	2·00	1·60	1·40	1·10
Specific gravity (relative)	1000	1254	1636	1659	1744	1822	1915	1995	2274	2294	2313

Washed Chars—Dry.

	Ordinary Char.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Carbon	61·12	44·94	49·87	49·71	51·11	57·24	52·40	55·31	54·41	58·50	59·24
Phosphate of lime	5·39	7·41	10·31	14·16	18·41	20·68	24·50	24·68	26·51	26·00	26·58
Carbonate of lime	19·55	27·19	19·16	16·11	11·74	6·20	5·60	2·54	0·93	1·00	2·28
Carbonate of magnesia	3·48	6·51	5·40	4·02	4·76	5·17	4·80	4·25	3·71	3·50	2·88

TABLE B.

Total Increase per cent on Original Char Used.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Dry solid matter	33·25	79·55	126·45	166·45	217·65	249·65	295·65	347·69	391·59	455·09
Char	6·20	23·08	44·71	59·65	80·61	98·48	116·88	136·68	154·24	183·40
Sulphate of ammonia	30·07	69·02	89·70	117·28	147·86	178·30	210·01	246·26	276·91	316·26

Residual Chars.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Water	—	—	—	—	—	—	—	—	—	—
Soluble salts	8·14	21·05	38·28	56·96	74·64	96·81	109·99	128·73	143·67	166·93
Insoluble	5·36	12·15	14·28	12·04	15·36	11·18	16·00	17·21	20·33	26·06
Soluble.										
Chlorine =	5·16	10·53	19·18	26·71	34·77	46·15	57·03	67·40	74·58	88·95
Chloride of sodium	8·59	17·53	31·92	40·52	57·96	76·88	95·04	112·33	124·46	146·59
Sulphuric acid	0·24	0·95	1·67	5·26	6·36	7·84	4·02	4·54	5·34	1·62
Phosphoric acid	—	—	—	—	—	—	—	trace	trace	trace
Potash	2·13	4·86	6·32	11·93	14·22	21·01	23·37	26·01	29·49	34·79
Insoluble.										
Carbon	*12·00	*4·47	*2·85	*3·31	5·36	*2·53	1·76	0·82	5·04	11·82
Silica	4·04	6·15	7·02	4·89	2·06	3·17	2·99	3·17	2·07	*0·05
Phosphate of lime	2·19	5·53	9·88	13·64	16·80	19·36	20·25	22·10	21·61	24·92
Carbonate of lime	8·25	1·78	*0·70	*5·64	*10·92	*11·86	*14·81	*16·46	*16·38	*14·86
Carbonate of magnesia	3·04	1·01	1·22	1·67	2·30	1·65	1·22	0·67	0·45	0·01
Specific gravity	25·40	63·60	65·90	74·40	82·20	91·50	99·50	127·40	129·40	131·30

* Decrease.

TABLE C.

INCREASE PER 1000 PARTS OF URINE.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	Average.
Dry solid matter	33·25	39·77	42·15	41·61	43·53	41·60	42·23	43·46	43·51	45·51	41·66
Char	6·20	11·54	14·90	14·91	16·12	16·41	16·69	17·08	17·13	18·34	14·93
Sulphate of ammonia ..	30·07	34·51	29·90	29·32	29·57	29·71	30·00	30·78	30·73	31·62	30·62

RESIDUAL CHARS.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Average.
Water	—	—	—	—	—	—	—	—	—	—	—
Soluble salts	8·14	10·52	12·76	14·24	14·93	16·13	15·71	16·09	15·96	16·69	14·12
Insoluble	5·36	6·07	4·76	3·01	3·07	1·86	2·28	2·15	2·26	2·60	3·34
Soluble.											
Chlorine = ...	5·16	5·26	6·37	6·68	6·95	7·69	8·14	8·42	8·28	8·89	7·18
Chloride of sodium	8·59	8·76	10·64	10·13	11·59	12·81	13·58	14·04	13·83	14·66	11·86
Sulphuric acid	0·24	0·47	0·55	1·31	1·27	1·30	0·56	0·56	0·59	0·16	0·70
Phosphoric acid	—	—	—	—	—	—	—	trace	trace	trace	—
Potash	2·13	2·43	2·10	2·98	2·84	3·50	3·34	3·25	3·27	3·48	2·93
Insoluble.											
Carbon	*12·00	*2·23	*0·71	*0·83	1·07	*0·42	0·25	0·10	0·56	1·18	*1·30
Silica	4·04	3·07	2·34	1·22	0·41	0·53	0·42	0·39	0·23	—	1·40
Phosphate of lime	2·19	2·76	3·27	3·41	3·36	3·22	2·89	2·76	2·40	2·49	2·87
Carbonate of lime	8·25	0·89	*0·23	*1·41	*2·18	*1·98	*2·11	*2·06	*1·82	*1·48	*0·41
Carbonate of magnesia ..	3·04	0·50	0·40	0·42	0·46	0·27	0·17	0·08	0·05	—	0·59
Specific gravity	25·40	31·80	21·96	18·60	16·44	15·25	14·21	15·92	14·37	13·13	18·71

* Decrease.

TABLE D.

RESULTS OF TREATING CLOSET EXCRETA.

No. of Expt.	No. of Deposits.	Weight, Wet.	Weight, Dry.	Char Used.	Char Produced.	Char, Increase.	Liquid Distilled.	Tar	Acetate of Lime.	Free Ammonia as Sulphate.	Combined Ammonia as Sulphate.	Total Ammonia as Sulphate.	
		Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Grs.	Grs.	Grs.	Grs.	
1.	7	Estimated weight, 490 ozs.	Estimated weight, 110 ozs.	48·00	48·00	—	65·50	Estimated weight, 10 ozs.	Estimated weight, 1977 grs.	1229·00	Estimated weight, 1712 grs.		Partial Analyses.
2.	6			48·00	48·00	—	21·50			643·00			
3.	5			44·00	48·00	4·00	20·50			613·00			
	18												
4.	19			76·00	81·50	5·50	37·50			1310·00		11310	
	37												
5.	24			80·50	93·00	12·50	38·50			1721·00			
	61												
6.	24			93·00	104·00	11·00	34·50			1852·00			
	85												
7.	24			98·00	107·50	9·50	39·50			2230·00			
	109												
8.	24	113·00	36·00	104·50	111·50	7·00	53·50	2·50	479·60	1756·00	268·00	2024·000	Complete Analyses.
	133												
9.	24	93·00	18·00	105·50	108·50	3·00	34·50	2·50	503·60	1502·00	343·00	1845·000	
	157												
10.	24	112·00	18·00	98·00	102·50	4·50	33·50	1·50	300·80	1278·00	215·00	1493·000	
Total	181	808·00	182·00	795·50	852·50	57·00	379·00	16·50	Ozs. 7·46	Ozs. 32·32	Ozs. 5·81	Ozs. 38·130	
								Grs.	Grs.	Grs.	Grs.	Grs.	
Average per deposit		4·46	1·00	4·39	4·71	0·32	2·09	39·76	18·01	78·08	14·02	92·100	
Per cent, wet ..		100·00	22·44	98·43	105·62	7·19	46·86	2·04	0·92	6·24	0·71	6·950	
Per cent, dry ..		—	100·00	439·00	471·00	32·00	209·00	9·10	4·12	27·84	3·19	31·030	

Char dried and used seventeen times; re-burnt ten times. The distillations also produced about 1 oz of light hydrocarbon.

TABLE E.

ANALYSES OF CHARS FROM CLOSET.

	Ordinary Char.	Composition. 1.	2.	3.	4.	5.	6.	Increase, per cent. 1.	2.	3.	4.	5.	6.
No. of Deposits		37	85	109	133	157	181	37	85	109	133	157	181
No. in Table D.		4.	6.	7.	8.	9.	10.	4.	6.	7.	8.	9.	10.
Water	10·00	1·20	1·20	2·00	1·80	—	—	—	—	—	—	—	—
Soluble	0·60	4·70	9·20	8·30	10·10	9·20	9·60	4·10	8·60	7·70	9·50	8·60	9·00
Insoluble	89·40	94·10	89·60	89·70	88·10	90·80	90·40	4·70	0·20	0·30	*1·30	1·40	1·00
Soluble.													
Chlorine =	—	2·16	3·45	3·69	4·16	4·50	4·75	2·16	3·45	3·69	4·16	4·50	4·75
Chloride of sodium	—	3·60	5·75	6·15	6·93	7·50	7·91	3·60	5·75	6·15	6·93	7·50	7·91
Sulphuric acid	0·30	0·85	1·00	trace	1·02	0·68	1·40	0·55	0·70	—	0·72	0·38	1·10
Phosphoric acid	—	trace	trace	trace	trace	trace	trace	trace	trace	trace	trace	trace	trace
Potash	0·30	0·30	4·10	3·46	3·46	4·61	5·57	—	3·80	3·16	3·16	4·31	5·27
Insoluble.													
Carbon	54·40	41·80	42·20	44·80	41·50	44·00	43·40	*12·60	*12·20	*9·60	*12·90	*10·40	*11·00
Silica	9·10	15·20	12·40	12·50	12·80	12·00	11·80	6·10	3·30	3·40	3·70	2·90	2·70
Phosphate of lime	4·80	13·50	15·60	20·00	21·06	21·20	21·40	8·70	10·80	15·20	16·26	16·40	16·60
Carbonate of lime	17·40	20·40	12·40	8·60	7·00	11·60	11·20	3·00	*5·00	*8·80	*10·40	*5·80	*5·40
Carbonate of magnesia	3·10	3·50	5·60	1·20	2·10	2·00	2·00	0·40	2·50	*1·90	*1·00	*1·10	*1·10
Specific gravity (relative)	1000	1319	1638	1720	1769	1700	1667	31·90	63·80	72·00	76·90	70·00	66·70

WASHED CHARS.

	Ordinary Char.	Composition. 1.	2.	3.	4.	5.	6.	Increase, per cent. 1.	2.	3.	4.	5.	6.
No. of Deposits		37	85	109	133	157	181	37	85	109	133	157	181
No. in Table D.		4.	6.	7.	8.	9.	10.	4.	6.	7.	8.	9.	10.
Carbon	54·40	44·46	47·98	51·43	49·13	49·43	48·22	*9·94	*6·42	*2·97	*5·27	*4·97	*6·13
Phosphate of lime	4·80	14·37	17·41	22·96	24·93	23·34	23·77	9·57	12·61	18·16	20·13	18·54	18·97
Carbonate of lime	17·40	21·70	13·83	9·87	8·28	12·77	12·44	4·30	*3·57	*7·53	*9·12	*4·63	*4·96
Carbonate of magnesia	3·10	3·30	6·25	1·37	2·48	2·09	2·22	0·20	3·15	*1·73	*0·62	*1·01	*0·88

* Decrease.

matter is characteristic of excreta, and is shown in the large quantity of tar yielded in the distillation—over 9 per cent; wood yielding only 10 per cent, and coal 12 per cent. The yield of ammonia equals 31 per cent of sulphate, showing this to be a most prolific source. It is remarkable that the re-burning shows the products of distillation of vegetable matter—acetic acid, for instance, combined with those from animal matter, as ammonia, for example, arising from the mixed nature of the human food. These experiments were conducted on excreta from poorly-fed lads: amongst good livers, the nitrogen, phosphates, and fatty matter would probably be much increased. These tables represent, therefore, the minimum yield. Taking these data, 1 ton of char which had been used five times would yield, allowing 15 per cent moisture, 48 cwts. of manure, containing nitrogen equal to 18 per cent sulphate of ammonia, 15 per cent phosphate of lime (reckoned as soluble), and 7½ per cent sulphate of potash, and worth £7 per ton. Its cost for char, £2, and for cartage, 5 tons in and 10 tons out, equal 15 tons at 1s., equal 15s. If advisable to hasten its sale by drying, it would cost 10s. more, the total cost being £3 5s., or about 28s. per ton. If re-burnt and returned to the closet, the re-burning would cost 3s. 6d. per ton, or 8s. 6d., and yield over 8 cwts. sulphate of ammonia at 16s., equal £6 8s. less cost of acid, and, allowing 10 per cent for moisture, 33 cwts. of char, partly to return to the closet and partly for sale as manure, and worth about £5 per ton. I think these data are sufficient to show that this process presents the means of recovering the total value of the excreta. In addition, there are other unexpected sources of further profit; for 100 tons of dry, solid excreta yield 9 tons of tar and 4 tons of acetate of lime, besides a considerable quantity of richly-illuminating gas.

I have brought this subject before the Section in the full belief that it must some day become a chemical question; and I maintain that engineers have shown their incompetence to deal with it alone. Water-closet excreta is now admitted to be the worst poison to put into our rivers; and why should such volumes of water be thus employed for such pollution? If this large amount of water be unnecessary, if, moreover, it be grossly wasteful and fearfully prejudicial to health, it becomes our duty to discuss any other method by which chemistry may be made available to secure that which has hitherto been lost. I repeat here my conviction expressed in a former paper—that "Every system of sewage, to be permanent, must give back to the soil that which in our food we have taken from it; and the mere ridding ourselves of a valuable fertiliser simply on account of difficulty in dealing with it is unworthy the enlightened spirit of our age." At the same time, I admit that considerations of health must always precede those of wealth in this respect, and no system need be spoken of against which there is a whisper of suspicion on this point.

Nothing can be said against the dry-closet in this respect. It has already become a recognised institution. It presents the best means at present known of confining a nuisance within its proper limits, instead of distributing it amongst our neighbours, and therefore merits our patient consideration.

There can be no doubt that, for country houses, the earth-closet is free from objection; but there is also no doubt that, with earth, it could not be applied to large towns; but, with the modification proposed, its use will be profitable in direct proportion to the size of the town. By its use we are enabled to store the manure for the farmer, and dispose of it when he wants it, and not whenever we want to get rid of it, which materially affects the market price.

While, therefore, there can be no doubt of the healthfulness of this process, I believe enough has been proved in this paper to show that the gradual introduction of char-closets will become national steppingstones to health and wealth.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, October 11, 1869.

The first paper is by M. Duhamel, on the—

Principles of the Science of Forces.—This is the third portion of a work the author is occupied with, the two former parts treating of the science of numbers and the science of space. We mention the title because the writer is an excellent authority on this and kindred subjects.

Expansion of Gases.—M. Victor Regnault.—The author refers, first, to his series of experiments on this subject made since the year 1842, and states that he believed he had found a method to determine with the same apparatus, first, the specific heat of a gas under constant pressure and variable volume; and, secondly, its specific heat under constant volume, while the pressure varies so as to leave the volume (bulk) constantly the same. Next follows the description of a series of experiments, and conclusions drawn therefrom, made at a later date; while the lengthy memoir is devoted to what the author calls simple expansion, or static expansion—that is to say, the expansion of a gas while at rest, when, by any exterior force, the space it occupies is made larger and the gas comes to rest again after the expansion. The other kind of expansion, called dynamic, is, when a gas, either while at rest or moving, expands while passing through any opening, and escapes into the calorimetric apparatus with all the velocity it has acquired. This memoir is of very great length, and the subject treated with the well-known ability of this eminent author, who, it will be remembered, satisfactorily settled the theory of the pressure of steam under various conditions.

Maximum of Force of Electro-Magnets.—M. du Moncel.—A mathematico-physical treatise.

Electricity Developed by the Dissolving of Salts in Water.—M. Raoult.—The author says the dissolution of a salt in water is a complex phenomenon whereby we distinguish—1st, the *fusion* (melting), or *disintegration* of the salt, whereby heat is absorbed; 2nd, the *diffusion* of saline molecules in water, which also absorbs heat; 3rd, the *combination* of the salt with water, whereby heat is set free. The author then states that the conditions alluded to under Nos. 1 and 2 do not produce any electricity, but that, on the other hand, the combination of a salt with water certainly does give rise to an electric current, to prove which the author records a series of experimental results.

Condensation (Occlusion) of Nascent Hydrogen.—M. Raoult.—The author states that the small cubes of metallic nickel ordinarily met with in commerce, and which are rather porous, absorb (condense) at least 165 times their bulk of nascent hydrogen under the same conditions as palladium does. The metallic nickel employed was not pure, but was found to consist, in 100 parts, of:—Nickel, 88·4; copper, 8·1; iron, 2·7; arsenic, 0·8. Perfectly pure, but yet porous, nickel exhibited the same phenomenon; but not so the compact refined, rolled, or hammered nickel.

Analysis of Raw Yellow Silks of Commerce.—M. Mène.—A series of figures exhibiting the results of the elementary and proximate analysis of a great many varieties of raw silks obtained from divers silk-producing countries of the world. The specific gravity appears to vary between 1·670 and 1·80. The elementary organic analysis is not of much use, since silk in raw state contains:—Substances soluble in water, partly nitrogenous, partly carbohydrates; fatty, resinous, and colouring substances soluble in alcohol and ether; and, lastly, the genuine fibre, a nitrogenous compound again soluble in acetic acid. It is impossible here to quote a lengthy series of figures, which is the less required since it is a well-known fact that raw silk varies considerably, according to to the food, climate, and condition of the worms which secrete this substance.

Researches on Lydine.—M. Guyot.—The author states that when he tried to prepare a certain aniline colour according to the directions given by M. Stark, by treating acid chlorhydrate of aniline with ferricyanide of potassium, and by treating the precipitate with oxalic acid, he did not succeed in obtaining a red colouring matter, as stated by M. Stark. The author obtained, however, a beautiful violet colour, which he calls *lydine*, by the following process:—100 grms. of fuming hydrochloric acid, diluted with 120 c.c.; this mixture is poured into a solution of 90 grms. of the ferricyanide of potassium (so-called red prussiate) and 850 c.c. of water; next boiled for an hour and a half, and cooled. The precipitate which has been formed is washed by decantation, and re-dissolved in a nearly saturated aqueous solution of oxalic acid, whereby the violet colour is immediately developed; and, on evaporating this solution to dryness, a paste soluble in water is obtained, which is the extract of lydine. The acid solution just alluded to may serve for dyeing silk and wool without mordants; cotton mordanted with alumina assumes the dye, also, readily. Pure lydine is a beautifully blue violet-coloured powder, soluble in alcohol, difficultly soluble in ether and benzol, and insoluble in water.

Elimination of Lime from Natural Waters by means of Oxalic Acid.—M. Monier.—Upon 100 litres of water from the Seine, 20 grms. of oxalic acid are used, previously dissolved in distilled water; an abundant precipitate is formed; after the lapse of twenty-four hours, some 85 litres of water are carefully drawn off by means of a syphon; and, on analysis, it was found that fully two-thirds of the mineral matter contained in the water had been precipitated, and the water rendered very soft. It is clear, however, that the use of oxalic acid could not be made applicable on the large scale, for various reasons, even if the acid itself was less expensive.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 14, 1869.

This number contains the following original papers:—

Preparation of Crystallised Silica by the Dry Way.—M. Rose.—After referring to the experiments made on this subject by himself and others, the author states that he resumed his researches on this subject at the Royal Porcelain Manufactory, at Berlin, and was aided in his work by MM. Elsner and Herzog. The mineral, named adular, was fused with three times its bulk of salt of phosphorus. The fused mass was dissolved in dilute HCl; and perfectly well-defined crystals, though of very small size, were obtained; the specific gravity of these crystals varied from 2·311 to 2·317 for a series of experiments made with the same substances. The silicic acid thus obtained has the properties of tridymite. Another series of similar experiments, made with very pure amorphous silica, yielded, again, microscopically-small crystals; but their shape did not differ from those obtained with adular. A large number of similar experiments were made with different fluxes, leading to the result that the preparation of crystallised silica by the dry way, or fusion process, has as yet only succeeded in the production of crystals shaped like tridymite and opal. The author is engaged in further investigations on this subject.

Bases of the Picoline Series.—M. A. Baeyer.—Picoline is obtained when tribromallyl is strongly heated with alcoholic solution of ammonia. There is, at first, formed dibromallylamine, and, next, picoline. Aldehydine, a newly-discovered base, prepared also by this author, is homologous with picoline. During the formation of aldehydine, there are formed oxytetraldine, oxypentaldine, and also collidine.

On Cinchonine-Chinoline.—M. Lubavin.—When chinoline is heated for some days, at 100°, with fuming sulphuric acid, the result is the formation of chinosulphuric acid, $NC_9H_6.SO_3OH$. This substance is difficultly soluble in cold water, more readily so in hot water and alcohol, and insoluble in ether. When this acid is heated, along with water and bromine, at 100°, there is formed a bromated chinoline, and, not simultaneously, a bromated sulpho acid. When chinoline is treated with a concentrated solution of caustic alkali, a greenish blue-coloured substance is produced, which is also produced when cinchonine is so treated; on addition of water, this colour disappears, and there is then formed a brown-coloured amorphous substance.

Products of the Distillation of Raw Spirits.—MM. Krämer and Pinner.—The authors had an opportunity of investigating the different products which, by the distillation of spirits—that is to say, the manufacture thereof—from grain, are formed, and can be separately collected, owing to the perfection of the rectifying apparatus in use, on the large scale. Among these substances are prominent—aldehyde, acetal, propyl-alcohol, butyl-alcohol, acetic ether, fusel oil, and a mixture of different substances.

On Monobromobenzolsulpho-Acid.—M. Genz.—The acid just named has been first prepared by M. Couper. The author has obtained it by placing benzol-sulpho acid, bromine, and water in sealed tubes, and heating to 150° in an oil-bath for about five hours. After a lengthy process of purifying, a substance was obtained of which the baryta, copper, and ammonia salts were investigated, and the acid itself set free from the copper salt, by means of sulphuretted hydrogen. The acid so prepared exhibits deliquescent crystals. The baryta salt, $Ba(C_6H_4BrSO_3)_2+H_2O$, is soluble in hot water and insoluble in alcohol. The copper salt, obtained from the baryta salt by double decomposition with sulphate of copper, crystallises readily, and is soluble in water and alcohol.

Nitro and Amido Derivatives from Cyanide of Naphthyl.—M. A. Welkov.—The author prepared, from α cyanaphthyl, $C_{11}H_7N$, a nitro-compound, which crystallises from its alcoholic solution, and is composed of $C_{11}H_6N_2O_2=C_{10}H_6(CN)(NO_2)$. From that compound, the amido base was obtained, by means of a reducing agent, the hydrochlorate of which has the formula $C_{11}H_8N_2Cl$.

Some Derivatives from Bromide of Aniline.—M. W. Otto.—Dibromated diphenylsulpho-carbamide, $C_{13}H_{10}Br_2N_2S$, a solid crystalline substance, soluble in alcohol, fusing at 178° and subliming at 200°; insoluble in water, both hot and cold, also insoluble in ether, and readily soluble in hot alcohol. Bibromated diphenyl-carbamide, $C_{13}H_{10}Br_2N_2O$, also a solid substance, sublimes at about 224°, with-

out entering into fusion. Quadribromated diphenyl-carbamide, $C_{13}H_6Br_4N_2O$, again a solid crystalline substance, difficultly soluble in any neutral menstruum. Bromated phenyl-senföl (essential oil of mustard), C_7H_4BrNS, a crystalline substance exhibiting the smell of aniseed, fusing at 60°, and soluble in alcohol and ether.

On Isomeric Xylidine.—Drs. A. W. Hofmann and C. A. Martius.—This paper, and the following—

On Naphthaline Red—Dr. Hofmann—are not well suited for abstraction with due regard to the contents and the labour of the authors.

Action of Cyanogen upon Anthranilic Acid.—M. Griess.—The author, after having briefly reviewed his former investigations on the action of cyanogen upon amido-benzoic acid, treats, in this paper, at very great length, on the action of cyanogen upon a compound, $C_{10}H_{10}N_2O_2$, being a product of the action of cyanogen upon an alcoholic solution of anthranilic acid left standing by itself for several days. We regret that it is impossible to enter into further abstraction of this paper, owing to the fact that we should be obliged to reproduce so large a number of formulæ.

Description of an Apparatus for Exhibiting Combustion Experiments in a Lecture-Room.—M. Kekulé.—Without the reproduction of the two woodcuts added to this paper, it is not possible to make the description properly understood.

On Ethyl-Benzoic Acid.—MM. Thorpe and Kekulé.—The authors and M. Fittig, having, some years since, synthetically prepared ethyl-benzoic acid from ethyl-benzol, the question treated of in this paper is, to decide whether the ethyl-benzoic acid obtained in this manner is identically the same as that obtained by the last-named party, by means of the oxidation of diethyl-benzol. The result of a carefully-instituted comparative research of the acids obtained in these different ways is that they are quite identical with each other.

On Acetylbenzol.—M. Glaser.—Acetylbenzol, phenylacetylen, $C_8H_6.C_2H$. This body has been prepared by the author from phenyl-propiolic acid and styrol, and which has been obtained by MM. Berthelot and Friedel by other means, is possessed of the remarkable property of combining with metals and metallic oxides, some of which are treated of in this paper. The copper compound of acetylenbenzol, $(C_8H_8.C_2)_2Cu_2$. Diacetenylphenyl, $C_{16}H_{10}$, is a solid substance, soluble in boiling alcohol and insoluble in water; it is a peculiar hydrocarbon, obtained when acetenylbenzol copper is treated with a concentrated alcoholic solution of ammonia. Acetenylbenzol sodium, $C_8H_8.C_2Na$; this substance has only an ephemeral existence; it is instantaneously decomposed, both by moist and dry air.

Communications from the Chemical Society at Zurich, called the Chemical Harmonica.—M. Meister writes—"At the meeting held on the 27th of July last, MM. Merz and Weith spoke about acetanilide. In pure state, this substance is soluble in hot water, fuses at 113°, crystallises very readily, and is decomposed by sulphuric acid, acetic acid being set free and sulphate of aniline formed. In order to detect acettoluide among acetanilide, the acetic compound is dissolved in four parts of glacial acetic acid, and next mixed with about eighty parts of water; hereby the acetanilide remains dissolved, while the acettoluide is precipitated. MM. Baltzer and Merz obtained, by distilling a mixture of potassium-disulphonaphthalate and cyanide of potassium, a peculiar cyanide of high melting point, soluble in hot alcohol; this dicyannaphthaline is entirely acidified (*acidificirt*) by treating it with alcoholic solution of potassa, or by HCl at about 199°, while ammonia is at the same time generated.

Derivatives from Uramidobenzoic Acid.—M. Griess.—Uramidobenzoic acid, $C_8H_8N_2O_3$, is prepared by the action of a mineral acid upon a peculiar basic compound, $C_{99}H_{30}N_4O_9$, obtained by the action of cyanogen and an alcoholic solution of amidobenzoic acid. In this lengthy monograph, the author treats of several derivatives obtained from the uramidobenzoic acid by the action of nitric acid; among these new compounds, dinitro-uramidobenzoic acid, $C_8H_6N_4O_7$, is soluble in alcohol and ether, yielding, on evaporation, well-defined crystals. The paper is too concisely and abstrusely written to be fit for further condensation.

Illustration of the Phenomena of Combustion for Lecture Experiments.—Dr. A. W. Hofmann.—We greatly regret that, in consequence of the absolute necessity of the woodcut added to this paper, for it to be properly understood, we cannot abstract this communication of the eminent author.

Nature of Aniline Green.—MM. Hofmann and Girard.—We have already briefly noticed this memoir (see Chemical News, vol. xx., p. 153). This German paper is identical with the French one already alluded to.

On those Compounds of Essential Oil of Mustard which are Isomeric with Hydrosulphocyanic Acid.—Dr. A. W. Hofmann.—This is a fifth paper on this subject, not well suited for condensation with due regard to the labour bestowed upon the contents by the learned author.

Researches on the Products of Desulphuration of Diphenyl-sulphocarbamide.—Dr. A. W. Hofmann.—This memoir is too lengthy and too concisely written for any useful abstraction.

On some Superiodides.—M. Jürgensen.—This paper is an abstract of a larger memoir on this subject. The author treats of the superiodides generated when neutral or acid solutions of the hydrochlorates of morphia, codeia, papaverine, narceine, and narcotine are treated with solutions of iodine in iodide of potassium, in which case superiodides are formed which exhibit crystalline structure. Tetraiodide of morphia, $C_{17}H_{19}NO_3HI_4$, is precipitated in crystalline form when, to the aqueous solution of the salt of morphia, an excess of iodide of potassium is added. Teriodide of codeine and teriodide of papaverine, the former, $C_{18}H_{21}NO_3HI_2$, the latter, $C_{20}H_{21}NO_4HI_2$, have been found to contain hydriodic acid, since the alcoholic solutions, when shaken up with metallic mercury, yield double salts, only containing two equivalents of mercury. Sesquiiodide of narceine, $(C_{23}H_{29}NO_9)_2H_2I_2$, is formed when a very dilute solution of the hydrochlorate of the alkaloid is left standing for several weeks, after having been mixed with a dilute solution of superiodide of potassium. The author has extended his researches to piperine, atropine, berberine, theobromine, chinine, cinchonine, methylchinine, methylchinidine, ethylchinine, and ethyl-cinchonine; also to tetrethylphosphonium; but the great length and the large number of formulæ contained in this paper forbids us entering into more details on this subject.

This number of the periodical contains the queries to which answers are requested:—1st. By the Royal Prussian Academy of Sciences at Berlin; to be replied to before the 1st of March, 1870. The question proposed is the synthesis of either one or more such alkaloids as chinine, cinchonine, morphine, strychnine, brucine, or any non-nitrogenous compound so related to these bodies, that, by the action of ammonia, it can be converted into the aforesaid bases; prize, 100 ducats, about £50. For 1872, the same premium for a full investigation of the nitrogenous substances contained in wheaten flour and rye flour, and the changes these substances undergo when acted upon by water. 2nd. The Association for the Promotion of the Industry of Prussia asks—The preparation of an enamel on cast-iron, of variegated colours, to be unaffected by exposure to air, and to have proved effectual for at least one year; premium, 300 thalers (£45). For a suitable substitute for the use of arsenic acid in the manufacture of fuchsine (aniline red), provided the substitute be no more expensive and not poisonous or dangerous to deal with; a gold medal, or 1000 thalers (£150). For good replies to the subjoined questions, the same premium:—(1) A method whereby the quantity of aniline and toluidine contained in commercial aniline (*anilinöl*, literally aniline oil) can be accurately, readily, and speedily determined; (2) to determine the influence which the various mixtures of these two substances have in regard to the quantity of aniline obtained; (3) to estimate what weight will yield the largest quantity of crystallised pigment. These three particulars have each to be answered in order to satisfy for the premium. The last meeting of the Chemical Society of Berlin, was held on the 11th of October, this being the report of the meeting held on July 26th last.

Bulletin de la Société Chimique de Paris, September and October, 1869.

These two numbers have been published together, and contain the following original matter:—The *procès verbaux* of the meeting of this Society, held on the 2nd and 16th of July last, from which we learn that M. Personne described two new combinations of sulphuric and pyrogallic acids obtained by him. One of these, a conjugated disulphuric acid, exhibits needle-shaped crystals; its baryta salt is efflorescent. This compound is accompanied by a blue substance, a product of oxidation. In addition to these, there is formed a monosulphuric acid, a solid substance, crystallising in large crystals, which, on the addition of baryta, yields a beautiful purplish colour. The author has estimated the sulphuric acid in these compounds by burning them in a current of oxygen gas, and conducting the products of combustion into a solution of permanganate of potassa, and precipitating the sulphuric acid by means of baryta. M. Grimaux spoke on a new kind of nitriles, the oxygenated nitriles of the aromatic series. Salicylo-nitrile, C_7H_5NO, is obtained by the dehydratation of salicylamide by keeping it at a temperature of from 280° to 300°. The new product is a solid body, crystallising in yellow-coloured crystals, fusing at about 285°; almost insoluble in ether, alcohol, chloroform, sulphide of carbon; soluble in 200 parts of boiling oil of turpentine, soluble in aqueous and alcoholic solutions of caustic potassa, and, by fusion with that substance, is transformed into salicylic acid.

The following papers and memoirs were read:—

On a Homologue and Isomer of Choline.—M. Wurtz.—This paper is chiefly intended to point out the identity of neurine and choline, which last-named substance was originally found by M. Strecker in bile, while neurine, as discovered by the author of this paper, is artificially produced by the action of triethylamine upon hydrochlorate of glycol.

Action of Hydrochlorate of Glycol upon Toluidine.—M. Wurtz.—The author describes the action of hydrochlorate of glycol upon aniline and toluidine, exposing at great length the different reactions which take place, and the preparation of divers salts, especially with platinum as basis. The memoir is too lengthy to admit of useful abstraction.

Synthesis of Naphthalin-Carboxylic Acid.—M. Eghis.—This acid is obtained by acting with sodium amalgam upon a mixture of monobromated naphthalin and chloroxycarbonic ether. The acid obtained appears to be identical with the menaphtoxylic acid of A. Hofmann, but differs from the carboxylic acid obtained by means of the cyanide of naphthyl prepared from sulpho-naphthylate of potassium by M. Merz.

Action of Anhydrous Sulphuric Acid upon Perchloride of Carbon.—M. Schutzenberger.—There is produced a liquid boiling at 130°, decomposed by water into sulphuric and hydrochloric acids, fuming in the air, and giving off a smell which is similar to that given off by some of the chlorides of the metalloids. The action of anhydrous sulphuric acid upon tetrachloride of carbon is represented by the following formula:—$S_2O_6 + CCl_4 = CCl_2O + S_2O_5Cl_2$.

Synthesis of Glucosides.—M. Schutzenberger.—The chief result obtained by the author is that the synthesis of genuine glucosides which agree in their properties with those formed naturally

is possible by means of the double decomposition of the acetic glucoses (*glucoses acétiques*) and the lead or soda salts of several organic principles. The author is engaged in further researches on this subject.

Acetic Derivatives of the Sugars.—MM. Schutzenberger and Naudin.—This paper is too lengthy and too concisely written to admit of useful abstraction.

Inuline and its Acetic Derivatives.—MM. Ferrouillat and Savigny.—The authors have prepared inuline from dahlia root and from the root of the inula helenium. Notwithstanding that these substances have been carefully manipulated, so as to ensure the purity of the inuline, it appears that, from the experiments made, that this substance, as obtained from either of the two roots named, does not behave in the same manner when treated with acetic acid under exactly similar conditions, but yields products of decomposition which vary greatly. It is impossible to enter into details about these researches, since the paper is too lengthy for that purpose.

Oxidation of Pseudocetylic Alcohol.—M. Clermont.—The products obtained are the same as those yielded by castor-oil when it is oxidised.

Action of Permanganate of Potassa upon Cinchonine and the Existence of a New Alkaloid of the Cinchona Species.—MM. Caventon and Willm.—We have given an abstract of this from another publication.

Salts of Phenetosulphuric Acid.—MM. Opl and Lippman.—Phenetol is—

$$\left.\begin{matrix} C_2H_5 \\ C_6H_5 \end{matrix}\right\} O$$

It boils at about 169°. The authors describe a baryta salt of this substance, $(C_6H_5SO_6,C_6H_5O)_2Ba'' + 4H_2O$, a phenetolsulphate of baryta, nearly insoluble in cold, but soluble in hot, water. Phenetosulphate of lead, crystallising in cauliflower-like masses, soluble in water. Phenetosulphate of potassium—

$$\left.\begin{matrix} C_6H_5SO_6K \\ C_2H_5 \end{matrix}\right\} O + H_2O$$

is obtained by decomposing the baryta salt by means of carbonate of potassa. The salt obtained is readily soluble in water, and crystallises in needle-shaped crystals.

Structure of Cubical Pyramidal Crystals.—M. Wyrouboff.—This paper is not suited for abstraction, being a strictly crystallographico-geometrical paper.

Cresotic and Salycilic Acids.—M. Vogt.—By means of a complicated process, commenced by acting upon chlorinated xylen with fuming sulphuric acid, an acid has been obtained which is soluble in hot water, insoluble in cold water; soluble, also, in alcohol and ether, and violet-coloured by salts of iron. This acid is composed, in 100 parts, of:—C, 63·1; H, 5·12; O, 31·78. When toluen was treated in the same manner, salicylic acid, $C_7H_6O_3$, was obtained.

Succinate and Benzoate of Isopropyl.—M. Da Silva.—We have already abstracted the contents of this memoir, which was also published in another periodical.

There is added to this number a loose sheet, bearing title—

Ecole Supérieure des Sciences Appliquées de Mulhouse (*Laboratoire de Chimie*).—From this programme, approved and signed by the Recteur de l'Académie de Strasbourg and other authorities, we learn that there exists at Mulhouse an excellently-arranged school for the education of those who are either to be the heads or future managers of industrial works of various kinds. There is attached to this school a large and well-fitted chemical laboratory, wherein every opportunity is given for practical working, and at a very moderate expense, considering that thirty hours a-week are devoted to chemistry alone. The regular course of this school extends over two years, after which period those who desire it are examined, and certificates are granted, which are considered as rigorous proof of real efficiency. This school is, in miniature, what the celebrated Ecole Centrale des Arts et des Manufactures at Paris is on a large scale. Both these schools were originally established by private enterprise, and have become highly and deservedly esteemed, and are therefore fully approved of by the authorities of the Université de France.

Polytechnisches Journal von Dingler, first number for September, 1869.

This number contains the following original papers relating to chemical science:—

Proper Mode of Applying Zinc-White as a Pigment.—Dr. Dingler.—The author disapproves of the use of any substances containing lead, or any preparations thereof, along with zinc-white. He recommends, instead of the use of ordinary boiled linseed oil, to mix the zinc-white with an oil prepared in the following manner:—200 lbs. of linseed oil are gently boiled, first, for some five or six hours alone, and, next, boiled again along with 24 lbs. of coarsely-broken-up peroxide of manganese for at least twelve hours; in this manner, a very quickly-drying linseed oil is obtained, which is eminently fit for the purpose of being used with zinc-white and other zinc colours. The author lays stress upon the use of old linseed oil, and also upon the care to be taken with the boiled oil, which unless carefully kept from access of air, becomes thick in a very short time. The boiled oil so prepared ought not to be used in painting with zinc-white by itself alone, but should be mixed, in quantities of from 3 to 5 per cent, with the raw linseed oil used to mix up the paint.

Optical Milk Test.—Dr. Heeren.—This is a lengthy essay on a subject of great importance. The author points out that chemical analysis only is the proper mode of testing the quantity of butter contained in milk; but he also observes that this requires more knowledge, and also more time than those practically interested in this subject can devote to it. The author then reviews a variety of instruments devised for the purpose of testing milk; among these, M. Chevalier's crémometer is noticed. In the first place, the awkwardness of this instrument is due to the fact that the milk has to stand therein for at least twenty-four hours; and, although for milk intended for butter-making this is no objection, it is not desirable for daily use. The optical milk-testing apparatus devised by M. Donné, in the year 1843, and M. Vogel, in 1862, are described, and their value reviewed. The general results obtained by this author may be recapitulated as follows:—Skimmed milk contains fat globules of smaller size than unskimmed milk; smaller globules produce a relatively greater turbidity than larger-sized globules. Since the value of the optical milk-test is based upon the degree of non-transparency, it cannot yield correct results for wholly or partly skimmed milk. Carefully-made experiments prove that the use of M. Vogel's galactoscope gives perfectly correct results, but only for pure and unskimmed milk. By means of a combined optico-chemical investigation, it is possible to detect the precise quantity of fatty matter withdrawn from milk. The increase of the specific gravity of milk by skimming it is in direct proportion to the quantity of fatty matter withdrawn.

Quantitative Analysis of Soap.—M. Span.—Too lengthy to admit of useful abstraction.

Crystalline Coloured Substance Prepared from Mica.—Dr. Tech.—This paper contains the results of researches made with the view to detect the colours applied to minute pieces of mica used for ornamental purposes under the name of *brocate*. The following colours were tested:—*Rose red.*—Proved to be cochineal. *Carmine red.*—The colour is soluble in hot water; ammonia destroys the colour, HCl makes it yellow; colour is soluble in spirits of wine; the colour of that solution is destroyed by ammonia; colouring matter is, therefore, fuchsine. *Violet.*—Hardly soluble in water; completely soluble in water acidified with acetic acid; discoloured by ammonia; turns first green, and then yellow, by addition of hydrochloric acid. *Bright blue.*—Insoluble in water and water acidified with acetic acid; insoluble in alcohol; soluble in aqueous solution of oxalic acid; discoloured by alkalies. *Berlin blue.*—Deep blue; as far as tests could prove, this appeared to be Girard's violet, green, a mixture of aniline blue, and turmeric. Violet blue was evidently obtained with log-wood, and this was also applied to black.

Non-Porous Copper Castings may, according to the editor, be obtained by melting copper in plumbago crucibles previously lined inside with pipe-clay and dried. As soon as copper, while in molten state, is in contact with coal or carbonaceous matter, it yields a porous and spongy casting.

Pharmaceutische Zeitschrift für Russland, August, 1869.

This number contains the following original papers:—

Contributions to a Monograph on Inuline.—M. Dragendorff.—This paper is the first instalment of a memoir on inuline; it contains—(1) an historical introduction; (2) an essay on the different species of plants and parts of plants in which inuline is found; to these belong *Inula Helenium*, L., *Taraxacum officinale*, *Cichorium Intybus*, *Anacyclus officinarum*, *Helianthus tuberosus*. Inuline (also known as *helenin*, *alantin*, *dahlin*, *menyanthin*) is chiefly contained in the roots of the plants alluded to; it is a substance isomeric with, and in its properties similar to, starch, and was discovered in 1804 by M. V. Rose; its formula is $C_6H_{10}O_5$. The paper on this subject is to be continued.

Comparative Essay on the Characteristic Properties of the Halogens and their Combinations, and particularly on Hyperiodic Acid.—M. Ferrein.—This is the last instalment of a very lengthy essay on this subject.

Method for Rapidly Separating the Nitrates of Silver and Copper from each other.—Dr. Palment.—The author had to prepare nitrate of silver from small silver coins which contained a large percentage of copper. The alloy is dissolved in nitric acid; the solution is filtered if necessary, and evaporated until it has the consistency of a thickish oil; when this point is reached there is added to the solution very concentrated nitric acid free from HCl. By this proceeding all the nitrate of silver is precipitated, while nitrate of copper remains in solution. One part of the concentrated metallic solution requires from three to four parts of nitric acid for the complete precipitation of the nitrate of silver; the more concentrated the nitric acid is so much the better, but acid of 1·250 sp. gr. answers the purpose. The solution of copper is decanted off, and the nitrate of silver washed with nitric acid.

Researches on the Excrements of the Silkworms.—Dr. Palment.—These excrements contain 13·33 per cent ash, composed of potassa, soda, a trace of magnesia, carbonic, sulphuric, phosphoric acids, and chlorine. Among the organic substances contained in these excrements, the author found starch, mucus, sugar, tannin, and a peculiar green pigment. The worms had been fed only on the leaves of the white mulberry tree.

On Jantak-Schakar.—Dr. Palment.—Under this name there is sold in the towns of Central Asia a yellowish-coloured, dirty, hygroscopic substance, which is used as sugar, but the author has not been able to learn how it is obtained and from what plant it is derived; he found it did not contain mannite, and yielded on analysis, in 200 parts:—Sugar, 56; water, 11·4; impurities, 21·7; the latter being partly woody fibre, and partly inorganic salts.

Researches on a Petroleum from the Kirgisensteppe.—M. Both.—This oil occurs in wells at a considerable distance from

Orenburg; its colour is brownish-black, its consistency like tar; specific gravity, at 14°, 0·87; it contains 17 per cent of water, wherein 0·80 per cent of sulphate of protoxide of iron, readily soluble in ether, alcohol, benzol, chloroform, oil of turpentine, and miscible in every proportion with fatty oils; boiling point, 380°. This oil is purified with great difficulty; it contains 1·87 per cent of sulphur.

Les Mondes, October 7, 1869.

This number contains the following original communications:—

On the Radiant Heat from the Moon.—M. Marié-Davy.—The author says:—I do *not* admit that there is any essential difference between light and heat; I do not say that the *vis viva* of the moon's rays is *nil*, but I say it is so infinitesimally small that it is incapable of raising the temperature of an air-thermometer upon which the moon's rays concentrated by a strong lens were directed 0·0004°; and the heat radiated is not sufficient to raise the temperature 0·000001° when the bulb of the thermometer is directly exposed to the moon's rays. Suppose we apply either a lens ten times stronger than the one we employed, or a thermometer ten times more sensitive, and we thereby magnify the effects of course so that a motion of 1 m.m. will take place which will be very perceptible. If my observations were contradicted by those made by the late Lord Rosse, that nobleman ought to have drawn from his observations the conclusion that the direct rays of the moon were capable of elevating the temperature of a thin blackened object 0·000001°. The sun's rays increase about 12° the temperature of a thermometer placed in an apparatus invented by the Rev. Father Secchi, S. J., the obvious result of my observation alluded to above would lead to the result that the *vis viva* of the sun's rays is 12,000,000 times larger than those of the moon's rays. The moon by no means reflects the total quantity of rays which she receives, and since, in all probability, its radiation is diffuse, it follows that its rays when arriving upon our planet are weakened in the ratio of the square of the diameter of the moon's orbit and of the diameter of the moon itself. The moon's rays are not necessarily of the same composition as those of the sun, and it is a well-known fact that the calorific power is not proportionate to the illuminating power in the sun's spectrum. A common argand lamp placed at a distance of two metres from my experimental thermometer by the heat radiated from it caused the mercury to move through more than 1 m.m. of space, while the moon's image, though giving far more light, did not cause the mercury to move at all.

Naphtha as Fuel for Locomotive Engines.—M. Portski.—This Russian engineer has run a railway train successfully for a distance of 81 versts* from Charff to Kutschigan, the only fuel applied being raw commercial naphtha, instead of coal, coke, or wood.

The Journal of the Franklin Institute, August, 1869.

This number contains the following original papers and communications:—

Old and New Coal.—Dr. Morton.—The author says:—Attention has been lately drawn to a curious observation, which is given as a fact without sufficient explanation. In one case, where hard coal is used in large quantities for purposes of mere evaporation, it appears that some which has been kept on hand in open piles for five or six months is less effective by from 13 to 15 per cent than that fresh from the pit. The deterioration caused by the absorption of water is, of course, well known, but does not seem to apply to these cases. The fact here alluded to is very well known in this country (England), and also elsewhere on the European continent, but is not quite scientifically explained.

The New Chemical Nomenclature.—Dr. Ott.—This is the first portion of a lengthy paper which the author intends to publish on this subject. He says—"The deficiency of the present system of chemical nomenclature, though immensely felt for many years, has been chiefly brought to light by the astonishing strides of organic chemistry." The author points out the great inconvenience of a nomenclature containing names with seventeen or more syllables; though, in a less distinct manner, this deficiency is also felt in the domain of inorganic chemistry. We meet here such scarcely pronounceable denominations, as "hypersulpho-molybdate of potassa," "sesquibasico-ammoniaco-sulpharseniate of soda," and many others. The author proceeds to point out that the history of the spoken language of chemistry shows more clearly than that of any other science its various conditions in the succeeding stages of progress. The early cultivators of science hid their doctrines under the veil of an obscure figurative language, adopting at the same time particular characters for signifying bodies known to them. In the belief that the celestial bodies exercised a direct influence on terrestrial products, they consecrated the metallic and other substances to the seven so-called planets. As instances, we mention that to Saturn were consecrated the lead, litharge, and agate; to Jupiter, tin, corals, all white stones, and sulphur; to Mars, the iron, loadstone, and pyrites, and so on. Traces of this nomenclature yet remain in such terms as *Arbor Dianæ*, tincture of Mars, Martial pyrites, and lunar caustic. The term *sal* has been used since the oldest times for everything tasting like salt, or even for such substances as carbonate of potassa, which share only some properties with the same—viz., solubility in water, deliquescence, and colour. As instances of figurative expressions, we meet with *aqua ardens*, for alcohol, *lapis agnilinis*, &c. The author proceeds in this manner, passing in review the history of chemistry, but what has been quoted sufficiently exhibits the wide range he has taken for the full treatment of an interesting subject.

Camphoric Acid and some of its Combinations.—M. Fairthorne.—By repeated distillation of camphor with nitric acid, that substance is converted into camphoric acid by absorption of six equivalents of oxygen. The composition of camphor being $C_{20}H_{16}O_2$, that of camphoric acid is $C_{20}H_{16}O_8+2HO$. It (the acid) dissolves freely in alcohol and ether, moderately in water, but is insoluble in benzol and chloroform. It combines readily with ammonia and other alkalies; the ammonia salt crystallises in silky, star-like crystals. Its aqueous solution behaves, with the substances hereafter named, in the following manner:—With perchloride of iron, a light brown precipitate; no precipitate with the proto salts of iron; with sulphate of copper, a bright green precipitate; with solutions of salts of lead and mercury, dense white precipitates; no precipitation with sulphate of zinc, sulphate of morphia, sulphate of quinine, sulphate of cinchonia, sulphate of magnesia; none, also, with lime-water or soluble salts of silver. The author proposes to use the peculiarly bright green coloured precipitate yielded with sulphate of copper as a test for copper, since even 1 grain of sulphate of copper in a pint of water yields a distinctly perceptible colouration.

Cosmos, October 9, 1869.

Test for Berlin Blue.—The late M. Nicklès.—Shortly before his death, this *savant* pointed out that, when woven fabrics dyed with Berlin blue are steeped in a solution of fluoride of potassium, and then submitted to the action of steam, the colour of the tissue is at once discharged. Fabrics dyed with indigo or with aniline blue, when submitted to the same treatment, remain unchanged.

Drying of Wood.—For this purpose, the wood is kept for some hours under boiling water, whereby all its soluble parts are withdrawn. It is next left to dry, and then boiled for some time in a solution of borax, which causes the albumen to become soluble, and to escape from the pores. After this proceeding, the wood is placed in stoves heated by steam, and, in three days after the commencment of this series of operations, it has become quite dry and thoroughly seasoned.

NOTES AND QUERIES.

Magnesium Lamps.—(Reply to "C. Hunter.")—Messrs. Johnson and Matthey, of Hatton Garden, can give information about, and probably supply, every kind of magnesium lamp.

Magnesium Lamps.—(Reply to "C. Hunter.")—Larkin's magnesium powder lamp may be obtained of Mottershead and Co., Manchester.

Halliday's Machines.—Can any of your readers inform me where to find the makers of "Halliday's machines" for treating sawdust in the manufacture of pyroligneous acid and acetate of lime, and also the makers of the best wood-distilling apparatus.—A. W. N.

Carbonic Acid.—(Reply to CO_2).—Why not rather make carbonic acid by Ozouf's process, that is, by forcing air through previously strongly-ignited charcoal, contained in a properly constructed stove or furnace? It is true the gas thus obtained is contaminated with carbonic oxide and a very small quantity of combustible gases. The process alluded to by you is patented, I think, but it is certainly not a cheap process, and, if your limestone is tolerably pure, you had better dissolve it in either hydrochloric or sulphuric acids (both diluted with water, of course), and collect the gas thus set free.—J. A.

TO CORRESPONDENTS.

A Trustee.—It will be necessary for you to send your name and address before we insert your query respecting the Andersonian Institution.

E. N.—Apply to Messrs. Baillière, Regent Street, for the foreign journals you require.

P. Cox.—You will find information on the Uranium Process for Estimating Phosphoric Acid in Nos. 430 and 432.

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* There are in use two kinds of measures called versts in Russia, which differ rather considerably in value, but one of these measures is only used in the Baltic Provinces of Russia; the verst more generally in use has a value of 1066·78 metres, the English statute mile being equal to 1609·315 metres 81 versts is therefore equal to 53·6 English miles.

THE CHEMICAL NEWS.

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THE CHEMISTRY OF THE BLAST FURNACE, ACCORDING TO MR. I. L. BELL'S EXPERIMENTS.*

By M. CHARLES SCHINZ.

Mr. I. Lowthian Bell has lately read before the Chemical Society a paper on "The Chemistry of the Blast Furnace," this paper which is published in the Journal of the Society for June last, containing an account of a series of experiments which he has made on the process of the reduction of the iron ores in the blast furnace, and by means of which he intends to prove that this reduction takes place at a temperature much lower than that previously found by Scheerer, Ebelmen, and Tunner.

Mr. Bell comments at first upon the irregularity with which the layers in the blast furnace come down, and judges from that, that the volume of the blast furnace cannot be divided precisely into "zones." It should be stated, with regard to this, that it is absolutely wrong to charge a furnace with pieces varying much in size, this variation, of course, producing an unequal reduction and an irregular descent of the layers. But if this mistake is often made in England, it does not follow that the temperature in the blast furnace, with careful charging, should not decrease in an uniform and constant manner, so that it may really be divided into zones, limited by fixed temperatures: a difference of temperature is not even a necessary consequence of charging the furnace with pieces of unequal sizes, as the hot gases give up the heat with equal rapidity to large and small pieces, because this transfer depends simply upon the heat-conducting power of the materials. If, however, the free space between the pieces of the charge is not the same on both sides, the gases will rise much quicker on one side than on the other.

Of course small pieces of ore are more quickly and more completely reduced than larger ones, but large pieces, as well as small pieces, will be acted upon according to the existing temperature by the rising carbonic oxide; while, if they descend to such a depth of the furnace that the slag begins to run, the reduction ceases entirely, and afterwards it can only be accomplished, at a still higher temperature, out of the slag which contains oxide of iron by means of solid carbon. But that cannot influence the action of a zone of reduction, for the reduction by means of solid carbon is a different action, including other phenomena, and has to be examined separately.

If now the experimenters above named fixed the limits of their zones at very different heights of the shaft of the furnace, they have either erroneously taken the depth of the furnace as the extreme limit, whilst the volume of the zones ought to have been decided, or but very uncertain means of determining the temperature must have been at their command.

Mr. Bell has, on the other hand, put the ores to be reduced for a greater or less time into the iron pipes by which the gases are led from the furnace, and, moreover, into the pipes of furnaces of different size which, of course, give off gases of different temperatures; and, as he has thus found that a reduction takes place even at the melting point of bismuth (257° C.), he argues consequently that all that has been formerly stated about the temperature necessary for the reduction must be wrong. If Mr. Bell has really measured his temperature in a correct manner, of course then he is entitled to this conclusion; but it is a question whether Mr. Bell's measurement of the temperature does not depend upon a delusion. All compact metals possess a much greater heat-conducting power than the ores. If we put upon the bottom of a gas-pipe pieces of ores and a piece of metal, the latter will not melt, for the atmospheric air cools the tube from below, and deprives the piece of metal which is in contact with the tube of the heat necessary for the melting, whilst the pieces of ores, with less conducting power, are exposed to a perceptible higher temperature.

If we suppose that the temperature of the pieces of ore was the same as that of the piece of metal which served for ascertaining the temperature, the conclusion at which Mr. Bell arrived is still only delusively correct, for the conditions of the chosen method of operating are different to those existing in the blast furnace. The quantity of gas passing through in proportion to the mass of ores is much larger in the pipe leading off the gas than in the shaft of the furnace itself. My own experiments (see *Documente Betreffende den Hokofen*) have proved that the reduction is as much accelerated by the proportionate quantity of gas as by the amount of carbonic oxide which these gases contain, and that the intensity of the reduction, therefore, depends together upon temperature, quantity, and abundance of CO, and that no comparable results can be obtained without taking into consideration, and without determining, all these three factors. The influence of the composition of the gases upon the process of reduction has been presumed by Mr. Bell, and he has therefore, made special experiments with gases of the furnaces at Wrbna and at Clarence.

These gases have, according to Mr. Bell, the composition:—

$$13\ CO + H,\ 16\ CO_2,\ 71\ N \text{ (Wrbna), and}$$
$$32\ CO + H,\ 6\ CO_2,\ 62\ N \text{ (Clarence).}$$

But such a composition of blast furnace gases is almost impossible, for these gases must contain, if no direct reduction by means of solid carbon takes place, for 100 equivalent of nitrogen, 26·6 equivalent of vapourised carbon, and 26·6 equivalent of oxygen, plus the oxygen added by the reduction of the ores.

Now, the gases of the Wrbna furnace contain:—

$$13\ CO \text{ and } 16\ CO_2$$
$$6{\cdot}5 \quad ,, \quad 16 \quad = 22{\cdot}50\ O$$
$$\text{for } 100\ N \quad = 31{\cdot}69\ O;$$

the surplus of oxygen from the ores would thus be only—

$$31{\cdot}69 - 26{\cdot}51 = 5{\cdot}18;$$

well, but whence came the 16 CO_2?

Besides 13 CO and 16 CO_2 contain
6·5 ,, 8 vols. = 14·5 C.,

which gives 20·42 carbon instead of 26·51 for 100 N.

The result of Tunner's analysis is, therefore, decidedly wrong.

The composition given for the gases of the Clarence furnace, namely:—

$$32\ CO,\ 6\ CO_2,\ 62\ N,$$

is just as false.

These gases contain 22 volumes of O for 62 N, and this for 100 N = 35·48 O; next, also, they have 19 carbon for 62 N, or for 100 N there would be 30·64 carbon. The surplus of O thus equals 8·88 per cent, and of C = 4·04 per cent.

The gases of Clarence Iron Works should have, according to Mr. Bell's own calculation, the composition—

Cold Blast.

Weight of carbon	32·79	= volume	30·48
,, ,, oxygen	50·22	,,	35·11
,, ,, nitrogen	142·60	,,	113·48

per 100 N = 26·86 C. / 30·94 O.

* *Engineering*, October 22, 1869.

Hot Blast.

Weight of carbon	23·34	= volume	21·76
,, ,, oxygen	35·82	,,	25·04
,, ,, nitrogen	92·73	,,	60·74

per 100 N = 35·82 C. / 41·22 O.

The surplus of oxygen would be, in the first case, 4·43 per cent, and in the latter case 14·71 per cent; the surplus of carbon in the first case, 9·31 per cent, and in the latter case, 0·35 per cent. But that does not correspond with the analysis which gives surplus of O = 8·88, and surplus of C = 4·04.

I only mention this examination of the analyses in order to show how easily such analyses are used for final conclusions, without proving whether they are really correct.

The incorrectness of these analyses had no influence upon the application which Mr. Bell has made of them. He intended to show with the first composition of gases that reduction still takes place even with a small proportion of CO, and that has really been the case; but not the least thing is proved by that, for oxide of iron when brought into contact at a sufficient temperature with gases which contain only a trace of CO, will change that CO into CO_2, if not as easily, at least as completely, as oxide of copper, which is used for ascertaining by means of combustion the quantity of CO contained in gases.

Mr. Bell next discusses the question, how the saving of fuel by means of a hot blast is to be explained. We have here especially to mention that with a cold blast an increase of the fuel will always produce a product richer in carbon and graphite, whilst an increase of the temperature by means of a hot blast will never secure the same success. This fact alone should have opened long ago the eyes of mining engineers as to the real cause of the effect of the hot blast; for if a hot blast effects a saving of fuel in the furnace, the disposable amount of carbonic oxide will be naturally much decreased, and the reduction as well as the carbonisation of the product, by that agent, will be prejudiced. But as all, or almost all, iron is gained from the ores by applying a hot blast, the reduction which cannot any longer be produced in a complete manner by carbonic oxide, must necessarily be effected by means of solid carbon. That is the solution of the problem relating to the wonderful effect of the hot blast.

The diagrams (deduced from Ebelmen) which Mr. Bell gives, and which show that with a cold blast CO appears only 5 feet about the tuyeres, whilst with a hot blast this height is increased to 9½ feet, lead to a very erroneous conception of the case. Although these results of Ebelmen were both obtained at Clerval, the construction of the furnaces differed very much from each other. The furnace of 1839 with hot blast had only a capacity of 11·27 cubic metres, whilst the capacity of the furnace of 1841 with cold blast was 23·98 cubic metres, and the total heights of these furnaces were only 8·67 and 10 metres.

Calculating now the volumes of the separate parts of the furnace, we find that in the one furnace, as well as in the other, with hot blast as well as with cold blast, carbonic oxide alone exists after the blast has passed through a fifth of the total capacity of the furnace.

113 kilos. of coals, requiring 3880 kilos. of air for their transformation into CO, are consumed per hour if a hot blast is applied. If these 3880 kilos. are heated to 182° C., $3880 \times 0{\cdot}24 \times 182 = 169478$ units of heat are introduced into the furnace, the heat representing $\frac{169478}{2400} = 70{\cdot}6$ kilos. of coals.

The heat in the furnace corresponds thus with a quantity of coals equal to $113 + 70{\cdot}6 = 183{\cdot}6$ kilos. If a cold blast is used, 153·5 kilos. of coals are hourly consumed. The quantity of heat in the furnace with a hot blast is thus greater by an amount equal to $183{\cdot}6 - 153{\cdot}5 =$ 1 kilos. of coals. Whereas the hot blast produces per hour only 85 kilos. of pig-iron, and the cold blast 119 kilos.

The consumption of fuel in the furnace is thus per 1 kilo. of the product:—

$$\text{For a hot blast} = \frac{113}{85} = 1{\cdot}33.$$

$$\text{For a cold blast} = \frac{153{\cdot}5}{119} = 1{\cdot}29.$$

The latter system is, therefore, the most advantageous one, and the favourable effect of the hot blast disappears in the present case altogether. But the only reason for that is, that the capacity of the furnace with a cold blast is more than twice as great, as this increase of the capacity has the same effect as the hot blast.

Mr. Bell tries to prove the same thing in a different manner, but he makes from the beginning a mistake by supposing that equal quantities of heat must give the same results; his experiments are, therefore, in this respect without any value. It can also not be admitted that increase of the height of the furnace effects, under any circumstances, the same saving in the consumption of fuel as the hot blast. An increase of the height of the furnace, without altering the other dimensions proportionately, demands also a greater pressure of the blast, which can only be produced by an increase of power; but this increase of power requires for its generation also an increase in the consumption of fuel. Mr. Bell ought to have said that an increase in the *capacity* (instead of an increase of the height of the furnace) effects a saving.

But, also, an increased capacity of the furnace produces only then a saving of fuel equivalent to the hot blast, as at Clerval, if the hourly consumption of coal in the larger furnace is not greater than in the smaller furnace, as it was the case at Clerval, where the proportion of the consumption was $\frac{113}{153{\cdot}5}$ and that of the capacity $\frac{11{\cdot}27}{23{\cdot}98}$ Only in that case the capacity of the zone of reduction is increased in proportion to the ores passing through, and that is what has to be attempted in order to produce a cheap and, at the same time, good pig-iron.

ON THE SYNTHESIS OF GLUCOSIDES.

By M. P. SCHÜTZENBERGER.

ETHERS composed of sugar, and considered as polyatomic alcohols, are generally designated under the name of glucosides and saccharides. The synthesis of glucosides has only been effected at present with sundry organic monobasic acids (butyric, acetic, stearic, benzoic), by two methods.

1st. By the direct union of two compounds (sugar and hydrated acid), subjected to a prolonged contact and to a temperature of between 100° and 120° (Berthelot).

2nd. By the action of acetic anhydride upon sugar (Schützenberger). This latter method is less general than the former, but has the advantage of producing an entire transformation in a very short space of time.

My object has been to utilise the easy production of acetic derivatives from sugar, to prepare by double decomposition glucosides which are more complex, and whose composition more nearly approaches that of natural products, such as salicine, amygdaline, quercetine, rhamnine, &c. Here are the results of my researches.

1. Upon heating with benzine a mixture of soda-saligenine, $C_{14}H_{13}NaO_3$, and triacetic glucose at the boiling point of benzol, the following are formed:—Monacetic salicetine $C_{14}H_{11}(C_2H_3O)O_2$, glucate of sodium or an analogous salt, acetate of sodium, and a small quantity of a substance soluble in water, alcohol, benzol, precipitable by acetate of lead, and capable of being split up sharply into salicetine and glucose by boiling with dilute sulphuric acid. If triacetic glucose be replaced by diacetic glucose or diacetic saccharose, reactions of the same kind will be

obtained. Under these conditions acetic sugar and soda-saligenine exchange their acetyle and their sodium, a small portion of the bodies present reacts in another way, producing acetate of sodium and a glucoside containing the elements of saligenine.

2. Better results are obtained by heating, in the presence of water, a mixture of acetic glucose and the plumbic compound of saligenine. The quantity of saligenic glucose thus formed is then much greater. I do not insist upon the centesimal composition of this product, as I have been unable to crystallise it, and do not know if it be a definite and unique compound.

3. An aqueous solution of acetic saccharose was heated with the plumbic compound of rhamnetine. The latter is perfectly insoluble in water, and yields on separation, rhamnegine, the colouring matter of buckthorn berries, acetate of lead, and a glucoside colouring matter soluble in water and alcohol, staining tissues yellow mordanted with alumina.

This glucoside colouring matter is precipitated by the acetate of lead which forms simultaneously; it is obtained in a state of purity by decomposing with sulphuretted hydrogen the yellow deposit remaining after the experiment. The soluble yellow pigment separates, upon boiling with diluted mineral acids, into glucose and insoluble rhamnetine.

4. Acetic sugars, amygdaline, salicine, acetic tannin, when heated with an aqueous solution of benzoate of soda, yield acetate of soda, and corresponding benzoic derivatives, of which more will be said at a future time.

The facts here stated prove that the method of double decomposition applied to acetic derivatives of sugar, has succeeded partially, and might, perhaps, serve for the synthesis of complex glucosides.—*Comptes Rendus.*

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 194.)

In the old days of microscopic manipulation, no means was known of preserving objects but that of mounting them dry. The usual plan was to mount about six objects in an ivory slide, between discs of mica, secured with a brass ring: thin glass was unknown at that time. Mounting in Canada-balsam was, after this, hailed as a very great improvement. Whether the idea was suggested or not by insects preserved in amber there are no means of ascertaining. Very often ideas are suggested by natural occurrences, and it would seem likely that some attempt might be made to imitate these specimens of Nature's mounting. Gum and various varnishes were tried, until, at last, Canada balsam was found to succeed.

Canada balsam may be considered as a natural varnish. It is one of the substances known as oleo-resins, and is, according to the "Micrographic Dictionary," the product of *Pinus Balsamea*, although, possibly, it may be obtained from more species of the *Coniferæ* than one: something nearly similar is found in every pine-wood—the turpentine exuding from many of the trees. Canada balsam, like some other varnishes, possesses a power of drying more or less readily according to circumstances. It dries more quickly at a moderate heat than otherwise; is readily soluble in ether, turpentine, and benzole; and possesses the advantage of being highly refractive—nearly as much so as glass, thereby rendering the view of the edges of objects clearer when examined by transmitted light, by diminishing the diffraction—that power which light seems to have of going round a corner under certain circumstances, and which causes objects, under high powers, to show ill-defined margins when viewed in air. Canada balsam is also capable of soaking into tissues, and rendering them much more transparent than they would otherwise be. A much clearer view of the interior of semi-opaque objects, and, frequently, of objects that are too dense to transmit any light, can be obtained by its means than possibly could be without it. But, while it has the advantage of rendering tissues very transparent, and, at the same time, preserving them in an undoubtedly permanent manner, it is sometimes liable to render them almost invisible by inducing an excessive transparency; it is, also, applicable only to those substances that can be dried without injury. This, of course, prohibits its use with a very large class of tissues, the minute details of many animal and vegetable structures being obliterated by drying, either by ordinary desiccative processes, or the absorption of their water by means of strong alcohol;—a process which frequently induces great contraction in a substance treated with it, but which is sometimes taken advantage of when it is required to harden a soft tissue.

The process of mounting in Canada balsam is not a very difficult one. The chief obstacles are the presence of damp and air. A few air-bubbles in a preparation are of little consequence; but, if the preparation should be mounted at all damp, it will almost invariably fail. Damp makes itself known by a kind of fog surrounding the object.

If the object to be mounted can be dried on the slide, the mounting is extremely easy. Place upon it a drop of Canada balsam; warm gently over the lamp chimney until it runs, but do not let it boil; then place the cover glass on with the forceps, letting one edge touch first and bringing the cover down gradually, so as to expel any floating air-bubbles with the surplus balsam. Should there be any doubt about the penetration of the balsam, the object may advantageously be moistened with turpentine, or, still better, camphine, if it is to be procured. Objects especially liable to retain air should be prepared by a prolonged soaking in turpentine or benzole; and, in obstinate cases, the air-pump may be used with advantage to aid the saturation with the fluid. Small air-bubbles in a preparation need not be a source of anxiety, as they speedily disappear by absorption.

Sometimes the object may be placed upon the slide, the cover clipped down, and some balsam placed at the edge, which is then melted, and allowed to run in by capillary attraction. This plan has the advantage of causing little or no disturbance in the position of an object, and should always be used, if there is any tendency to curl upon the application of heat.

In some cases, the presence of air within a tissue is an advantage instead of a detriment. The lacunæ and canaliculi in sections of bone, and the tracheal-tubes of insects are much better shown when they are, as it were, injected with air. To retain the air, the treatment must be the reverse of that described. The balsam must be the thickest that can be procured, and the mounting done cold, or with the application of the smallest available amount of heat.

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

The surplus balsam around the edges of the cover will require to be cleaned off; but this must not be attempted until it has become hard and firm. The hardening of the balsam may be much accelerated by the application of heat. The inside of a fender is a very convenient place for drying balsam-mounted slides. A drying apparatus for effecting this more quickly is described by Mr. D. E. Goddard, in the *Transactions of the Microscopical Society of London*, January, 1864, p. 45.

The simplest way of removing the surplus balsam is to make it very hard, and then wet the slide, and scrape away the balsam with a wet knife. It comes off very readily, and leaves the slide so clean that it can be easily finished with a rag and a little methylated spirit. Where the balsam is not very hard, it is better to scrape away as much as possible with a hot knife, and remove the remainder with alcohol, being very careful not to disturb the cover. The knife for scraping the slide should be softened by heating to redness and allowing it to cool, or it will scratch the glass.

The forceps and needles may be cleaned from balsam by heating in a spirit-lamp, and wiping with rag or blotting-paper. The forceps should be common brass ones, as steel would soon be spoiled, and the needles kept for this particular purpose, as they are useless for any other. Balsam may be removed from the fingers by a free use of methylated spirit.

Canada balsam is best preserved for use in the collapsible tin-tubes used for containing oil-colours. As already mentioned, air is largely absorbed by balsam; indeed, most varnishes dry quite as much by the absorption of oxygen as by evaporation. The advantage of the tube as a receptacle is that the balsam is kept quite close to the top of the tube, and no air allowed to remain there, so the balsam may be preserved in a perfectly fluid state for a long period. Balsam has been kept for two years in these tubes, and been as limpid as when the tube was filled; while, in bottles, the balsam rapidly hardens, and becomes useless if long kept. The tubes have also the advantage of cleanliness in use: the supply is obtained by squeezing out the quantity required, the use of a dipper, an endless source of dirt and introduction of foreign substances, being dispensed with. Should a little balsam ooze out around the screw-cap, it can be scraped away with a hot knife. These tubes also form convenient receptacles for varnishes which are liable to injury by being exposed to the air—such as gold-size. They do not answer for varnishes made with naphtha or spirit, as these varnishes dry entirely by evaporation, and soon fasten down the cap.

Solutions of balsam in various media have been much used by some microscopists. They have the advantage of allowing the mounting of an object to be effected without the employment of heat, a great desideratum in many cases. Chloroform has been the medium hitherto employed for dissolving the balsam, which is previously exposed to a slow heat, until it is dried into a hard, resinous mass. It has been found, however, that objects mounted in this solution have frequently become cloudy, and that the solution, if kept for a considerable period, becomes turbid. Dr. Bastian recommends the use of benzole as a solvent, on the ground of its greater stability. He has made great use of the solution as a medium for making preparations of nervous tissue. A detailed account of his processes will be found in the *Monthly Microscopical Journal*, vol. i., p. 94.

The solution of balsam and benzole is most conveniently kept in a wide-mouthed bottle, with a ground cap instead of a stopper, which will allow a small pipette to be kept in the bottle. Should the fluid become too thick from evaporation, a little more benzole may be added.

Besides the use of balsam as a mounting medium, it is useful as a cement for a special set of purposes. The microscopist who makes the osseous tissues, rocks, or hard substances in general his particular study, will often require thin sections.

The preparation of a bone section will serve very well as an example of section-cutting, and polishing in general. It is required to make a very thin section of a recent bone, polished on both sides, to be mounted dry. The bone is to be cut into thin slices with a watch-spring saw. A level surface is then to be made on one side, by grinding down with water on a piece of blue-stone, or Water-of-Ayr. If the slice is very rough, time may be saved by using a file in the first instance, and finishing on the stone. The fingers may be protected from the action of the stone by bedding the rough section in a piece of cork.

The bone slices are to be cemented with Canada balsam, by their ground sides, to pieces of thick plate-glass; 1¼ inches by ⅞ of an inch is a convenient size for general use. The chief art consists in using the balsam of the right degree of hardness. A drop of balsam is to be placed on one of the slips, boiled on the hot plate, and allowed to cool. If, when cold, it is just capable of receiving a slight impression of the thumb-nail when pressed hard, it will do. If too soft, it must be heated again, and allowed to cool, and the process repeated, if necessary, until the right degree is obtained. If the balsam is not hardened sufficiently, it will clog the stone in the subsequent process; and, if too hard, it is liable to chip off along with the partially-finished section during the grinding. The piece of bone, cemented in its balsam bed, is to be ground down with water until the surface is levelled. It is then to be polished, so that no scratches appear upon it when examined under the microscope. This is done with putty-powder (oxide of tin, and not in any way connected with glaziers' putty), used with water upon a wash-leather strop. When the polishing is completed, the section is to be removed from the glass, which can be done by dropping it into a bottle of benzole, which will dissolve the hardened balsam, and release the section in a few minutes. A wide-mouthed stoppered bottle is convenient for this purpose, and the pieces of plate-glass are cut of the small size recommended, in order that they may be easily placed in and removed from the bottle. The half-finished section is now to be cemented to another balsam-bed, and ground down until it is sufficiently thin. With practice, 1-500th of an inch may be attained with a tough substance like bone. The author has approached this thickness even with fossil ganoid scales from the Weald clay. At first, it is well not to attempt too thin a section, and to practise on some material of which a large supply can be obtained. When ground sufficiently thin, the second surface is to be polished, and then detached as before, and afterwards washed in clean benzole, to remove all traces of balsam. The finished sections, when the benzole has dried off, are to be mounted dry by one of the usual processes.

Sections to be mounted in balsam will not require to be polished, as the balsam fills up, and, by its refractive power, apparently obliterates the scratches left by the grindstone. Other hard substances are treated in a nearly similar manner. Fossil bones and teeth, from their extreme brittleness, will require greater care in grinding, and, from their dark colour, must often be mounted in balsam, instead of dry. This is also necessary when they have a tendency to disintegrate. For very hard substances, such as teeth, the Arkansas stone would be of great service; but, unfortunately, it does not cut well when used with water, and, if oil is employed, the balsam is softened. A process devised by Dr. Christopher Johnstone about ten years ago, and published in *Silliman's Journal*, gives a process by which an oil-stone can be employed. The cement used is isinglass jelly, made with alcohol. Use is made of thin paper, as a guard against grinding away the section—an accident of frequent occurrence with beginners. The grinding is performed upon an Arkansas stone, with oil, and hot water is used to detach the section. The grease can be extracted with benzole. A detailed account of the process is given in the *Journal of the Quekett Microscopical Club*, 1869, p. 201. Accounts of the mode of cutting rock-sections, by J. B. Jordan, will be found in the same journal, p. 186, and, by D. Forbes, F.R.S, in the *Monthly Microscopical Journal*, vol. i., p. 240. The process of cutting sections of still harder substances, such as gems, is described by Mr, H. C. Sorby in the *Monthly Microscopical Journal*, vol. i., p. 220. Grindstones and polishing powders of various kinds can be obtained at the better class of tool shops, as Holtzapffel's, Buck's, Fenn's, &c.

Although it is the usual custom to cover slides containing dry and balsam mounted objects with paper, it is preferable to leave them without. A balsam-mounted preparation, well cleaned, and mounted on a piece of good patent plate with polished edges, is far neater than when covered with paper, which too often only serves to conceal an inferior quality of glass.

(To be continued).

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 5, 1869.

E. W. BINNEY, F.R.S., F.G.S., Vice-President, in the Chair.

"*On Nontronite*," by T. E. THORPE, Ph.D., communicated by Professor H. E. Roscoe, F.R.S., &c.

There exists some doubt among mineralogists as to whether nontronite is to be regarded as a distinct mineral species. Owing to the difficulty of obtaining it in a fit state for investigation, the few analyses hitherto published by Berthier, Dufrénoy, Jacquelin, and others, have taught us but little concerning its real nature. The following analysis, made on a comparatively pure specimen, may throw additional light on the constitution of this compound. The sample analysed was discovered, unclassified, in the Mineralogical Cabinet at Heidelberg, and was stated by Professor Blum, who was disposed to regard it as pinguite, to have been found in the neighbourhood of Heppenheim, in the Bergstrasse.

1·4155 grms. of the substance was heated with fuming hydrochloric acid until the mineral appeared to be completely decomposed. The solution was evaporated to complete dryness, and the separation of the silica effected in the usual manner.

Silica obtained, 0·5680 grms.

The weighed silica was then dissolved in caustic potash, and proved to be entirely free from sand or quartz.

To the filtrate from the silica were added a few drops of nitric acid, the solution boiled, and the iron precipitated by ammonia.

Ferric oxide, 0·5757 grm.

The weighed precipitate was next dissolved in strong hydrochloric acid, water added, and the solution filtered from a minute quantity of silica which had escaped separation by the previous evaporation.

Silica (not completely separated), 0·0030 grm.

Caustic soda was then added in slight excess to the filtrate, and the ferric oxide again precipitated, washed, ignited, and weighed. The re-precipitated ferric oxide weighed 0·5740 grm. Hence the substance was free from any appreciable quantity of alumina.

To the ammoniacal filtrate a few drops of ammonium oxalate were added, and the precipitate ignited, and determined as caustic lime.

Lime, 0·0380 grm.

On adding sodium phosphate to the filtrate, a mere trace of magnesia, appearing only after the lapse of some hours, was found.

The remaining constituent (namely, water) was determined by igniting the mineral in a stream of dry carbonic acid, carefully freed from air, until the loss of weight appeared constant.

1·1205 grms. substance lost 0·2311 grm. water.

Calculated from the foregoing analysis, the composition of the mineral is as follows:—

Lime	2·68
Magnesia	traces
Ferric oxide	36·44
Silica	40·30
Water	20·98
	100·40

On subtracting the lime, which evidently may be regarded as an unessential constituent, the percentage composition agrees very well with that required by the formula $Fe_2O_3 3SiO_2 + 5H_2O$.

	Found.	Calculated.
Ferric oxide	37·24	37·20
Silica	41·29	41·86
Water	21·47	20·94
	100·00	100·00

Nontronite is evidently a product of the decomposition by weathering of some siliceous mineral rich in iron. It possesses a light green colour, which, on the expulsion of water, changes to a dark chesnut-brown. It is perfectly opaque, and shows no evidence of crystallisation. Its fracture is uneven, and the lustre of its streak resinous. It is unctuous to the touch, and yields easily to the nail, and is somewhat harder than talc.

The following analysis by Biewend, made upon a specimen found at Andreasberg, agrees remarkably well with the foregoing determinations:—

Ferric oxide	37·30
Silica	41·10
Water	21·56
	99·96

Dr. SCHUNCK, F.R.S., called attention to a paper by Vogelsang and Geissler, on the nature of the liquids enclosed in certain minerals, such as rock crystal, topaz, and quartz, which appeared in the number of *Poggendorff's*

Annalen for last May. The authors find that these liquids (supposed by some observers to be hydrocarbons) always consist of liquid carbonic acid, mixed, in some cases, with a little water. The experiments by which they were led to this conclusion are fully described in the paper.

NOTICES OF BOOKS.

Elements of Chemistry: Theoretical and Practical. By WILLIAM ALLEN MILLER, M.D., LL.D., &c. Part III. *Organic Chemistry.* Fourth edition, with additions. Longmans. 1869. 976 pp.

DR. MILLER'S works on chemistry have become so thoroughly classical in chemical literature, that, at first sight, it may appear almost unnecessary to notice a new edition of one of them; it will be well, however, as the work has been revised and a good deal augmented, to point out the more important changes and afterwards to give a brief account of the general arrangement and classification of the subject matter.

The principal changes in this edition consist in the uniform adoption of the new notation, together with the system of nomenclature first introduced by Berzelius, then abandoned, and now revived by Wurtz and Cannizzaro, and generally adopted in the chemical world. The metrical system of weights and measures and the centigrade thermometric scale have also, in this edition, been placed side by side with our own scales and measures.

The entire work is divided into fourteen chapters, which gives an average of about sixty-eight pages to each chapter, and there is a further sub-division of each chapter into "parts" and numbered paragraphs. The first and introductory chapter treats of "Organic Analysis, Classification of Organic Bodies, Metamorphosis, Synthesis." Now it has been a good deal contested whether we should not abolish the term "Organic Chemistry," since the old distinction has fallen to the ground, and more than a thousand substances once believed to be formed and capable of formation only in the organisms of plants and animals, have been synthetically prepared in the laboratory of the chemist. Hence, at the outset of this work, we find a statement of the difference between *organic compounds* and *organised bodies*, the former of which can, in many instances, be prepared synthetically, while the latter are "the result of the action of living bodies upon inanimate matter," and cannot be prepared synthetically. Sugar, oxalic acid, and urea belong to the class of "organic compounds," while muscular tissue and ligneous fibre belong to the class of "organised bodies." As to the line of demarcation between inorganic and organic products, this does not exist, still, as Dr. Miller observes, "it is convenient to sub-divide chemical compounds into organic and inorganic; since those derived from the inorganic world, from the greater simplicity of their composition, afford to the student the most favourable instances for examining the fundamental laws of chemical combination, before he proceeds to the investigation of the more complicated products obtained from the operations of the living plant or animal."

The account of the analysis of organic bodies is followed by remarks on the classification of organic compounds, in the course of which the theory of compound radicles and of the Polyad Elements are discussed.

Chapter 2 treats of "The Saccharine or Amylaceous Group: Different Varieties of Fermentation," and is divided into four parts. The first is devoted to an account of the different kinds of sugar, and in it will be found (pp. 110 and 111) an extremely useful table giving a list of the various sugars, together with the principal properties and distinguishing characteristics of each. The table commences with cane sugar, and ends with pinite, $C_6H_{12}O_5$, which has been extracted by Berthelot from *Pinus Lambertiana*; it is a readily soluble substance, with a very sweet taste, not fermentable, incapable of producing mucic acid with nitric acid, and producing right-handed rotation of a ray of polarised light. Part 2 treats of the varieties of starch and gum, and contains an admirable statement of the theory of the action of ferments. Part 3, "Cellulin and Woody Fibre," includes an account of coal and other combustible materials, and useful tables of the analyses of coals. Part 4, "On Fermentation," treats of alcoholic, lactic, and viscous fermentation.

Chapter 3, "The Monatomic and Diatomic Alcohols and Ethers," is divided into seven parts, and extends over 120 pages. It commences with an account of the monatomic alcohols, passing to the ethers, and to the action of chlorine on ethers and alcohols. Part 5 treats of the "Metallic Derivatives of the Alcohols," commencing with zinc-ethyl; then kakodyle, AsC_2H_6, which was the first substance of this class, and was obtained by Bunsen; the name is unfortunate, especially if we are to call it kakodylide of kakodyle—$(AsC_2H_6)_2$ or Kd_2—; we certainly prefer the name *arseniodimethyl, or arsendimethyl*. There are hundreds of compounds in chemistry which might be called kakodyl with as much reason as arsendimethyl. The practice of naming a substance from one of many characteristics which it has in common with other substances cannot be too much reprobated or too soon abandoned.

Chapter 4 treats of the triatomic alcohols; "the Fats and Fixed Oils and Glycerine." Chapter 5 of the "Products of Oxidation of the Alcohols—Acids." The third part is devoted to the fatty acids, and the fourth to certain other vegetable acids, where will be found a detailed description of the modifications of tartaric acid, and mention of the remarkable series of acids obtained by Löwig by treating oxalic ether with sodium amalgam.

Chapter 6, "The Amides and Organic Bases," contains a very detailed account of the organic bases, commencing with the volatile bases which do not contain oxygen, and first of aniline. Among the natural bases we find the cinchona alkaloids, cinchonia, cinchonidine, and cinchonicine; the alkaloids of opium, of the peppers, of the *Strychnos* tribe, and, of tea, coffee, and chocolate. Chapter 7, "Of Essential Oils and Resins," contains Part 1 of Essences, 2 of Resins, 3 of Glucosides. Chapter 8 "Of Colouring Matters," contains a list of colouring matters obtained from lichens, and on page 665 we find an "Assay of Lichens for Colouring Matter." The most striking peculiarity of the lichen acids would appear to be their power of etherifying alcohol.

Chapter 9 contains an account of the "Products of Destructive Distillation." Chapter 10, "Compounds of Cyanogen; Bases of Animal Origin; Uric Acid and its Derivatives." The cyanides are divided into two classes—"Cyanides which do not contain Electro-negative Metallic Cyanides," among which are the zincic, plumbic, and palladious cyanides, and into "Cyanides which contain Electro-negative Metallic Cyanides," among which are the ferro- and ferri-cyanides, the nitroprussides, cobalticyanides and iridicyanides. Chapter 11, "Albumenoid and Gelatigenous Principles." Chapter 12, "Chemical Properties of some of the Solids and Fluids of Animal Origin;" and Chapter 13, "On the Nutrition of Plants and Animals." The two last chapters, which, together, extend over nearly 100 pages, will be of special use to medical students and those who devote themselves more particularly to physiological chemistry. Herein are discussed the chemical nature of—(1) the solid constituents of animals—bones, shells, horny matter, fibrous and elastic tissues, and of the components of the brain; (2) "Some Important Animal Fluids"—blood, chyle, lymph, milk, &c.; (3) the liquids concerned in digestion—saliva, gastric juice, bile, with a table of bile products; (4) excrementitious products—urine, excretin, and pus.

The fourteenth and final chapter is devoted to a discussion of "Atomic Volumes, and the Law of Boiling Points," and contains a number of useful and important tables. The first of these (pp. 921-924) shows the

density of a number of compound gases and vapours, and is arranged in the following order:—Name of compound, constituents, formulæ, density, calculated when H = 1 and when Air = 1, and observed in the latter case, and the authority. Next a table (p. 927) of the atomic volumes of elementary bodies; then the atomic volumes of certain oxides, sulphates, chromates, tungstates, carbonates, and nitrates, and of liquids of analogous composition. The remainder of the chapter is devoted to Kopp's law of boiling points. The fundamental proposition of this law is, as is well known, that for every addition of CH_2 in the empirical formula of compounds of ethyl and methyl, a rise of temperature of about 20° C. takes place in the boiling point; it has further been observed, as a general result of observation, "that the boiling point of a normal acid is 63° C. higher than that of its methylic ether, 44° C. higher than that of its ethylic ether, and 13° C. lower than that of its amylic ether; the boiling point of an alcohol of the form $C_nH_{2n+2}O$; is about 40° C. lower than that of its corresponding acid $C_nH_{2n}O_2$; a compound ether of the form $(C_nH_{2n+1}C_nH_{2n-1}O_2)$ boils at about 82° C. below the acid $(C_nH_{2n}O_2)$ which is isomeric with it." It is notorious, however, that very considerable discrepancies have been observed as regards the accuracy of Kopp's law, whether arising from inaccuracy of observation or from a defect in the law remains to be proved. Kopp has well observed in regard to these discrepancies "that it must not be assumed that the boiling points of liquids, when compared at *any* given pressure, will always exhibit the same differences as they do when compared at the average pressure of 30 inches (760 m.m.) of mercury. It does not follow, for instance, though the boiling point of ether is 79·5° below that of alcohol under a pressure of 30 inches, that under a pressure of 15 inches, the difference between these boiling points should still be 79·5°; since it is well known that what is called Dalton's law, viz., 'that all liquids at equal distances from their boiling point emit vapours of equal tension' is not correct."

The excellence of Dr. Miller's "Organic Chemistry" is so well recognised that it does not require one word of praise here. The very fact of its having reached a fourth edition (which is the fate of few large chemical works in this country), speaks for itself. Since Dr. Miller is constantly engaged in the teaching and the practice of chemistry, we are insured in his works the very newest matter, whether of theory or experiment. Thus we notice, in this edition, an account of the very recent researches of Messrs. Matthiessen and Wright on morphia and codeia. The constant reference to researches is of especial value, and if the year were more often added to the number of the volume and page of the work quoted, would be of still greater service. We regret to notice a somewhat large list of *errata* for a fourth edition, for although the corrections may be made once for all in ink, a work is always somewhat disfigured thereby. The use of a variety of types is now becoming more or less general in scientific works, especially on the continent, and when this can be done it certainly greatly facilitates reference; the broad thick letters and numbers are specially useful for the heads of paragraphs, while salts may be advantageously printed in small capitals, or with some other distinctive type characteristic: if in a later edition of the work we are considering this could be done, we think it could be consulted with greater readiness. We are almost surprised to find that Dr. Miller, whom we have been wont to account one of the more conservative chemists, has not only fully adopted the changes in the atomic weights and in the formulation of compounds, but has also introduced the changed names of substances, or, at least, one set of changed names. Thus it surprises us to find him speaking of "Plumbic Chloride," "Zincic Oxide," "Sodic Sulphate," and "Palladious Cyanide." The adoption of these terms by so eminent an authority will do much towards making them universal in the chemical literature of this country. We cannot help thinking sometimes, when we notice the extent and the variation of these changes, of the future of chemistry. If the science progresses in the next quarter of a century as much as it has in the last quarter (and there seems no reason to doubt that it will), there must of necessity be great and portentous changes. We cannot yet treat the facts of chemistry in a dogmatic and final manner. We cannot lay down such propositions as did Euclid of geometry; there is no absoluteness at present in our science; there is nothing of which we can speak with the same precision as we speak of the relation of the circumference of a circle to its diameter. And so long as this is the case some are of opinion that any changes tending to produce complexity should be avoided until their adoption has become, by the general consent of the chemical world both at home and abroad, a matter of absolute necessity.

CORRESPONDENCE.

BLOWPIPE CHEMISTRY.

To the Editor of the Chemical News.

Sir,—In my letter of the 17th of June, to your address, I state as follows:—"I reflected, however, that borax, being a compound salt, could scarcely be expected to give uniform results chemically, either as regards crystallisation or any other operation." The same reflection, together with a strong wish to obtain trustworthy reactions by the blowpipe through which the alkalies and alkaline earths could be detected, led me to try the colouration of Co solution with pure boracic acid, adding the alkali or earth to be experimented upon by traces at a time. I succeeded beyond my utmost expectation; the CoO, indeed, was scarcely at all dissolved in the pure BO_3; but I observed with my magnifying-glass spots of deep red-violet colour upon the cooler part of the platinum wire, which promised good results; and I found that, upon the addition of a trace of potash or soda, taken up on the hot bead, the CoO quickly dissolved, producing, in both cases, a pretty but light pink colour. I then generally (for I have made hundreds of experiments, with the detail of which I will not fatigue you) took upon the bead one more drop of Co solution, which deepened the pink colour, and showed a fine mauve-blue while hot. By the gradual addition of soda ($NaOCO_2$) to this, both the hot and cold beads were deepened in their tints, the former showing, for a moment, a deep blue-violet, and the latter remaining a splendid violet or purple colour. At last, the bead thus treated remains blue, both while hot and cold, and the amount of Na taken to effect this shows, I presume, pretty exactly that contained in borax.

The boracic acid cobaltine bead, treated in a similar way with potash, shows the same series of colours, but the potash blue is deeper, and has a dark violet tinge in it, which the soda blue has not, except when held against the flame of the lamp. On the addition of soda to a potash cobaltoboracic acid bead, this violet-blue is not changed, but even deepened; and the addition of potash to soda in a similar bead has a like effect. The addition of carbonate of lime to a boracic acid bead, with a drop of Co solution, produces a mauve-blue, opaque bead, magnesia a lavender-blue, opaque bead, both going through the gradations of pink, &c.

Fluor spar produces a clear bead; after a time, mauve-blue; so that the fluorine assists the boracic acid to dissolve the lime. Magnesia, assisted by a trace of potash or soda, may, by gradual addition, be made to go through the usual gradations of pink, &c., in a clear bead, until a mauve-blue is attained.

It will be proper here to detail two experiments showing the quantity of potash and soda taken respectively to satisfy an equal quantity of BO_3.

(1). "Measured very carefully half of 5 measures of BO_3, forming a bead about three-fourths the diameter of glass tube. Filled five measures with $NaOCO_2$; took a trace on hot bead, and added drop of Co solution; light pink, no undissolved Co discernible. Another drop Co solution; mauve hot, amethyst colour cold. Another trace Na; blue-mauve hot, dark purple cold. Trace more Na; lime-blue hot, blue-purple cold. Trace Na; deep mauve-blue hot, deep purple-blue cold. More Na; a little darker colours than before. More Na; mauve-blue. More Na; held against a bead of cobaltine borax, the blue still appeared mauve. More Na; not borax-blue yet. More Na; cobalt borax-blue. It took three-fourths of 5 measures (75 milligrammes); but, as it was a hydrated salt, containing, I should think, half its bulk in HO, I took half of this, or 35 milligrammes, to be the amount of $NaOCO_2$ taken to satisfy 50 milligrammes of boracic acid.

(2). Took half of 5 measures to form BO_3 bead, same size as last. Added drop Co solution and trace of $KOCO_2$ from 5 measures; pink, deeper than soda first trace. Added trace KO; light mauve hot, and light pink cold. Added drop Co solution; dark mauve hot, darkish purple cold. Trace KO; very dark blue hot, dark violet cold. Trace KO; dark mauve-blue hot and cold. Trace more KO; darker blue than last. Trace more KO; deep violet-blue, potash-blue. Took half of five measures (50 milligrammes), and, as it was also a hydrated salt, with less HO than the other, I estimated the quantity taken to satisfy the BO_3 as three-fourths of that, or 37·5 milligrammes; but I consider that too much, as I overdid the blue colour, and the KO was evidently more energetic in combination with BO_3 than Na, so that I should think it forms, with that acid, a triborate. I cannot procure caustic soda here, or would not have experimented with the carbonates of those alkalies.

(3). Filled five measures again, and took half to form a bead of BO_3, same size as before. (NB.—The loops of my platinum wires are all twisted of the same diameter). Filled five measures with $CaOCO_2$. Added trace Ca to boracic acid bead, with one drop Co solution; bead pinkish, with undissolved Co in spots. Trace Ca; opaque, lavender bead. Trace Ca; bead still opaque, of a blue-lavender colour, with spots of undissolved CoO, so added trace KO to clear it, and added trace BO_3 to make up for the KO; bead dark amethyst. Trace Ca; dark mauve hot, dark amethyst cool. Trace Ca; the mourning-violet colour cool. Trace Ca; deeper colour. Trace Ca; dark violet-blue, lime-blue. Took three-fourths of 5 measures (NB. This powder was extremely fine and dry, so that the above amount, 75 milligrammes, is, if anything, too little). I then made every effort, trying carbon, crystals of a solution of boracic acid in nitrate of cobalt, &c., to get the BO_3 to dissolve the CoO without the addition of an alkali, convinced, if I succeeded, I should get the beautiful wine-red or blood-coloured purple I had observed on the cool part of the platinum wire. I plunged the hot bead into cold water to cool it; I placed two small pieces of platinum wire in its centre for the same purpose, but without effect; and, as you will see from what follows, I found that BO_3 even acted as an alkali itself. Its energies are certainly feeble, and, even with a little KO, it failed to dissolve Cr_2O_3.

Reasoning analogically, I now concluded, as microcosmic salt gave a blue with Co solution not to be distinguished from that of borax, to attempt similar experiments to the above with pure or glacial phosphoric acid. I thought, at first, that I should have to make this myself, but was lucky enough to find two kinds in a chemist's shop here, who uses it in the preparation of some food. The kind which looked the purest, being like ice, I found, on being heated, gave off a smell of ammonia, and became so fluid as to drop off the platinum wire. I applied Co solution to what remained, and it immediately became blue—I presume, from the soda contained in the bones from which it was made. The other, in sticks like those of phosphorus, acted most energetically, and at once dissolved almost any quantity of CoO to a magnificent red-purple bead—the very colour I tried to get out of BO_3 and CoO in vain. On mixing BO_3 with this red-purple bead in considerable quantity, I obtained a blue, so deep that it appeared opaque, but, once seen, far surpassed in splendour of colour that of cobaltine borax.

I have not space or time to relate now my experiments with PO_5; but one fact is too important to omit, viz., that, with a slight trace of MnO_2 in the phosphoric bead, I obtained, by the persistent addition of soda, a rich brown colour, without any amethystine tinge, while potash gave, with the same oxide, an amethyst, with a far more purple tint than that of either the borax or microcosmic bead does with manganese.—I am, &c.,

W. A. Ross.

Simla, July 15th, 1869.

MISCELLANEOUS.

Glycoblastol.—Under this name there has been brought out at Vienna a cosmetic to be applied to the hair. It is simply made up of glycerine which has been digested with the rind of capsicum and perfumed with patchouli. As glycerine is by no means a proper substance to be applied to hair, this cosmetic, which is sold at an exorbitant price, ought not to be employed.

Fluid Glue.—To 1 kilo. of best glue dissolved, by the aid of a gentle heat, in 1 litre of water, 0·2 kilo. of nitric acid at 36° Beaumé (sp. gr. 1·334). After the at first rather strong evolution of nitrous acid vapours has ceased, the liquid is cooled and fit for use; a better product is obtained when dry clear glue (so-called gelatine) is treated and dissolved on a water-bath in its own weight of strong vinegar, one-fourth of its weight of alcohol, and a very small quantity of alum.

Elastic Glue.—Glue is dissolved in water by the aid of a water-bath, and evaporated until quite a thick fluid is obtained; to this a quantity of concentrated glycerine is added, equal in weight to the quantity of glue taken, and the evaporation is continued, while the mixture is frequently stirred, in order to drive off the remaining water; the mass is then run upon clean marble slabs, and cooled. This material is usefully applied for the inking-rollers of printers, and various other purposes.—*Deutsche Industrieblätter.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, October 18, 1869.

This number contains the following papers bearing upon chemistry and allied sciences:—

Metrical System: Critical Examination of the History of the Metre.—M. Chevreul.—From this lengthy paper we learn that, on the 14th of April, 1790, M. Brisson was the *savant* who proposed that a unit of measure should be taken from nature, by reading, at the Academy of Sciences, a paper "On the uniformity of measures of length, capacity, and weights, and on a new method of constructing the toise to be used as a standard." This paper of M. Brisson was written in consequence of the proposal made by the Bishop of Autun, as a member of the National Assembly, to render a uniform system of weights and measures compulsory by law throughout the entire French kingdom. The unit of measure of length proposed by M. Brisson was the length of the pendulum beating seconds at the latitude of Paris, which length had been very exactly determined by M. de Mairan, and found to be equal to 3 *pieds*, 0 *pouces*, 8 17-30ths *lignes*,

French measure. The Commission des Poids et Mesures, which was appointed after M. Brisson had made his proposal, preferred the 10,000,000th part of a quarter of the meridian of Paris as unit. The law of the 18th Germinal of the year III. (April 7, 1795) fixed the length of the metre, provisionally, at 3 *pieds*, 11·442 *lignes*. The law of 6 Messidor, year VIII. (June 25, 1800), fixes the length of the metre at 3 *pieds*, 11·296 *lignes*; the difference being −0·146. This length is the legal length of the metre, and is represented by an *étalon prototype* (invariable standard) deposited with the Academy. From 1836 to 1840, M. Puissant found there was an error in the calculation of the meridian distance of Montjouy to Formentera; and, accordingly, he found that the length of the metre should be 3 *pieds*, 11·375 *lignes*. The author of this paper comes to the conclusion, however, that, notwithstanding the slight errors found by MM. Puissant, Bessel, and others, the length of the standard metre, which is only 0·079 *lignes* different from the truth, is to be adhered to, also because of the very great inconvenience any change would cause, which is, after all, not essentially required for the uses of daily life.

Making of Standards of the Metrical System.—M. Jacobi.—This Russian *savant*, who, during his sojourn at Paris, was present at this meeting, read a paper on this subject, with the view of generalising the metrical system by the preparation of a large number of new standards made according to those deposited with the Academy, so that every centre of civilisation in Europe and elsewhere may possess one.

Oxidation of Pyrogallic Acid.—M. Aimé Girard.—The author of this paper points out that, when pyrogallic acid is oxidised in the presence of an acid, the products of its oxidation are different from those which are formed when the oxidation takes place in the presence of an alkali. Among the products there is one, $C_{40}H_{16}O_{18}$, which is a beautiful red-coloured substance, analogous to alizarine, and suitable to be used as a dyeing material. This substance is converted into picric acid by the action of nitric acid.

On Esmarkite.—M. Des Cloizeaux.—Esmarkite is a greyish-green coloured mineral; its fracture is conchoid; hardness holds the middle between apatite and orthose; sp. gr., 2·737. Composition, in 100 parts:—Silica, 47·50; alumina 33·70; lime, 15·40; magnesia, 0·56; soda. 1·84; potassa, 0·59; water, 0·94.

Observations of M. Victor Regnault on a Letter from Dr. Bosscha.—This lengthy paper contains a large amount of valuable matter in reference to thermometers, and among it the following:—The mercurial thermometer is not an instrument fit for being applied to the measurement of temperatures in experiments of precision, since it is not comparable (*manque de comparabilite*). Every mercurial thermometer which is to be applied for rigorously-exact experiments should be previously compared with a well-constructed air thermometer, both for degrees of temperature between 0° and 100°, as well as for higher temperatures. The learned author distinguishes three kinds of mercurial thermometers, viz.:—Standard thermometers, indicating from −10° to +110°; thermometers for high temperatures, graduated from −10° to +350°, but which should not be exposed to a heat higher than 300°; very sensitive thermometers for calorimetrical use, indicating from 0° to +30°. The mercurial thermometer is only a thermoscope; its indications should be converted into degrees of an air thermometer.

Electro-Chemistry: Physical Method to Determine the Molecular Groups which are Decomposed by a Galvanic Current.—M. Bourgoin.—According to this author, the electrolytic decomposition suffered by any compound indicates the grouping of the molecules of which that compound is made up; for instance, when sulphate of soda is decomposed by a galvanic current, it becomes evident, from the products of the decomposition, that the anhydrous salt has suffered dissociation, but not its hydrate; in other words, that the water remains inactive in this process.

Cause of the Ripening of Wines.—M. Béchamp.—The author demonstrates in this paper, at great length, that the same causes which bring on the decay of wine also act in maturing them, and giving them the precious properties recognised as *old*. It is impossible to enter into the details of this subject, which is, of course, practically important only to wine-growing countries; but it appears, after all, that scientific research on this subject is not yet quite exhausted, neither has it so elucidated this matter as to render it of easy practical application.

The American Journal of Science and Arts, vol. xlviii., No. 143, September, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Nature and Duration of the Discharge of a Leyden Jar Connected with an Induction Coil.—Mr. O. N. Rood.—This paper is the first part of a memoir read before the National Academy of Sciences. It is copiously illustrated with well-executed woodcuts, which are essential to the understanding of the paper.

On Durangite, a Fluo-Arsenate from Durango, in Mexico.—Mr. Brush.—The author states that he obtained, from a gentleman residing at San Francisco, a bright orange-coloured mineral found at the locality above named. The hardness of this mineral was 5, sp. gr. 3·95 to 4·03; it blackens on being moderately heated in a close tube, but regains its colour again on cooling; at a higher heat it fuses to a yellow glass, and gives a faint white sublimate; it fuses readily in reducing flame, gives a strong arsenical odour, and coats the charcoal with a faint white volatile sublimate. The mineral is only partially attacked by chlorhydric and nitric acids, but is completely decomposed by sulphuric acid, with evolution of fluorhydric acid. Qualitative examination showed the presence of arsenic acid, alumina, iron, manganese, soda, lithia, and fluorine. Search was made for other metallic and mineral acids and chlorine with negative result. The following is the result of quantitative analysis in 100 parts:—Arsenic acid, 55·10; alumina, 20·68; peroxide of iron, 4·78; protoxide of manganese, 1·30; soda, 11·66; lithia, 0·81; fluorine, undetermined, but present in very considerable quantity.

Remarks on the Galvanic Battery.—Mr. Hough.

On Nitric Acid and Chlorate of Potassium as an Oxidising Mixture Applicable to Sulphur, Sulphides, Chromium, Arsenic, and Organic Matters.—Mr. F. H. Storer.—This interesting paper will soon appear in full.

Action of Light on Uranium.—Mr. Bolton.—This memoir contains an historical and experimental review of whatever is known in relation to the action exercised by light upon uranium. The paper is too lengthy for any useful abstraction.

Action of Alkaline Nitrites upon Uric Acid and its Derivatives.—Dr. W. Gibbs.—After referring to the labours of M. Baeyer on this subject, the author describes, at great length, a series of experiments made by him. This paper has, however, been forestalled by a communication of the author written to Berlin, and abstracted by us from the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin* (see CHEMICAL NEWS, vol. xx., p. 131). The original paper was read before the National Academy of Sciences on April 15th last.

On the Meteoric Stone which fell December 5th, 1868, in Franklin Co., Alabama, U.S.—Mr. Brush.—This paper first relates, at length, the history of the circumstances attending the fall of this stone, which, on being received by the author, weighed 615 grms.; sp. gr., 3·31; soluble in HCl, only about 26 per cent. Result of analysis, in 100 parts:—Silica. 51·53; alumina, 8·05; ferrous oxide, 13·70; chromic oxide, 0·42; magnesia, 17·59; lime, 7·03; soda, 0·45; potassa, 0·22; sulphur, 0·23; a trace of nickeliferous iron.

On Lesleyite of Chester Co., Penn., and its Relations to Ephesite of the Emery Formation near Ephesus, Asia Minor.—Mr. Smith.—The author states that some years ago he analysed and described, mineralogically, under *emery*, the last-named mineral. The lesleyite has great similarity therewith. It is of a pearly white colour, and lamellar in structure; scratches glass easily; sp. gr., 3·15 to 3·20; heated before blowpipe, it becomes milk-white, but does not fuse; it is decomposed with great difficulty, by fusing, by carbonate of soda, even with the addition of a little caustic soda. Ephesite, in 100 parts, contains:—Silica, 30·70; alumina, 55·67; lime, 2·55; soda, 5·52; potassa, 1·10; water, 4·91. Lesleyite, in 100 parts:—Silica, 31·18; alumina, 55·00; lime, 0·45; soda, 1·20; potassa, 7·28; water, 4·80.

Artesian Well at Terre Haute, India.—Prof. Guyot.—Under the direction and at the expense of M. Chauncey Rose, a well has been bored, and a very exact account has been made of the thickness of the strata passed through and of the fluids met with:—At 840 ft., show of oil; 1276 ft., lubricating oil; 1335 ft., vein of fresh water; 1629 ft., oil vein; 1658 ft., blue sulphur water; 1710 ft., white sulphur water; 1768 ft., more white sulphur water; 1785 ft., large flow of white sulphur water, at the rate of 6000 gallons an hour. The temperature of the water at that depth is not quoted, neither is any further account given thereof; there is no statement, also, of the height above sea level of the surface of the bore-hole on the ground.

Sulphur Deposits of the Island of Saba, Netherlands West Indies.—Mr. Higgins.—The island of Saba belongs to the volcanic range of the Carribee or Windward Islands. The rock composing almost the entire formation of Saba is trachytic porphyry, which contains glassy felspar and hornblende in crystals, disseminated through a dark reddish coloured base. The sulphur deposit is located on the northern part of the island of Saba, and extends for a distance of more than a mile along the sea line. The stratum of sulphur varies in thickness from 15 to 50 feet; its elevation above sea level varies from 45 to 200 feet. This island has a surface of 16·5 square kilometres (about 9 English square miles, or 5760 acres), and contains 1794 inhabitants; it has been a Netherlands dependency for nearly 200 years, and is a portion of the Government of Curacao, along with Aruba, St. Martin (a portion), Bonaire, and St. Eustatius.

Journal für Praktische Chemie, No. 12, 1869.

This number contains the following original papers:—

Analysis of the Medicated Spring of Tönisstein, and of the Chalybeate Spring at the same place.—Dr. R. Fresenius.—To many of our readers who have made a trip on the Rhine, the Brohl-Thal will have been a pleasant excursion, and to those who made that trip, the two springs just alluded to will be well known. The author of this paper has divided it into two chief sections and several subdivisions. The medicated spring of Tönisstein has been known even so far back as the time when the ancient Romans occupied that country; and in the year 1864, the Prussian Government caused the spring to be properly cleansed out, and, by means of suitably-arranged masonry and tubing, to exclude any extraneous water. The water of this spring, which is evidently forced up by a pretty strong pressure of a constant stream of carbonic acid gas, is quite clear and very sparkling, owing to the carbonic acid gas constantly escaping from the spring; its taste is pleasant, but at the same time saline. The spring yields, on an average, 4908 litres of water in twenty-four hours, while, at the same time, there escapes a quantity of 650 litres of free CO_2; the temperature of the water was found to be 10·8°, while the temperature of the air was, at the time of making the experiment, 19°; the specific gravity of the water at 15° is 1·00598. The author made, first, a very carefully executed qualitative analysis of this

water, and then a quantitative analysis, the results of which are quoted in duplicate—in one case, the carbonates have been calculated as neutral salts; in the other, they are calculated as anhydrous bicarbonates. For each analysis, moreover, the quantities are expressed in duplicate—that is to say, first, upon 1000 parts of water; next, in grains, at 7680 to the Prussian pound. Upon 1000 parts of water, the carbonic acid salts being calculated as anhydrous bicarbonates, there are contained in this liquid:—Sulphate of potassa 0·09900; sulphate of soda, 0·14763; chloride of sodium, 1·41489; iodide of sodium, 0·00001; bromide of sodium, 0·00080; nitrate of soda, 0·00046; phosphate of alumina, Al_2O_3,PO_5, 0·00013; phosphate of soda, $2NaO,HO,PO_5$, 0·00018; bicarbonate of lithia, 0·00622; bicarbonate of soda, 2·57546; bicarbonate of ammonia, 0·00777; bicarbonate of baryta, 0·00008; bicarbonate of strontia, 0·00007; bicarbonate of lime, 0·55116; bicarbonate of magnesia, 1·63607; bicarbonate of protoxide of iron, 0·02949; bicarbonate of protoxide of manganese, 0·00043; silica, 0·02741. Total solid matters, 6·49816; free, that is to say, non-combined carbonic acid, 2·39334. The following substances are present in this water in quantities too small for determination by the balance:—Fluoride of calcium; borate of soda; organic matter, a mere trace; nitrogen, a mere trace. The Tönisstein chalybeate spring yields, on an average, a quantity of 9072 litres of water every twenty-four hours; this water, on being taken at the spring, is a quite clear, briskly-sparkling, refreshing liquid, yet at the same time ferreous to the taste. There escapes along with the water a considerable quantity of free carbonic acid gas, which amounts to some 6·840 litres during twenty-four hours. The temperature of the water of this spring was found to be 11·5°, while at the time this observation was made, the temperature of the air was 18°; the specific gravity of this water at 15° is 1·00270. 1000 parts of this water contain (the carbonates being calculated as bicarbonates):—Sulphate of potassa, 0·05444; chloride of potassium, 0·03575; chloride of sodium, 0·00911; nitrate of soda, 0·00102; phosphate of soda, 0·00040; phosphate of alumina, 0·00045; bicarbonate of lithia, 0·00048; bicarbonate of soda, 0·89325; bicarbonate of ammonia, 0·00410; bicarbonate of baryta, 0·00011; bicarbonate of strontia, 0·00156; bicarbonate of lime, 0·54075; bicarbonate of magnesia, 1·08154; bicarbonate of protoxide of iron, 0·05007; bicarbonate of protoxide of manganese, 0·00372; silica, 0·04107; entirely free CO_2, 2·33600. Total, 5·05382. The following substances are present in unweighable quantities:—Fluoride of calcium, iodide and bromide of sodium, organic matter, borate of soda, and nitrogen; of all merely traces.

Analysis of the Lamscheid Mineral Water.—Dr. R. Fresenius.—This paper is not a sterile account of a chemical analysis, but contains, as introduction, a most interesting historical review of a very anciently-known and renowned mineral spring, situated on the so-called Hundstriick, at an elevation of 1100 feet above the level of the Rhine, taken at Boppardt, and on the great Chaussée, leading from the last-named place towards Simmern and Trier, at a distance of about 12 miles from the Rhine. The water bubbles up from a deep depression in Thonschiefer; the well is properly provided with masonry, to protect it from the entrance of extraneous water. The physical qualities of this water are the following:—Perfectly colourless, briskly sparkling, taste very refreshing, acidulous, somewhat ferruginous, and no smell. The well yields, in 24 hours, about 14,900 litres of water; its temperature is 10·2°, when the temperature of the air is at the same time 20°. The specific gravity of this water at 23·7° is 1·00147. The quantitative analysis of this water, its carbonic acid salts being calculated as bicarbonates, yields, for 1000 parts, the following results:—Sulphate of potassa, 0·004918; sulphate of soda, 0·006995; chloride of sodium, 0·005869; bicarbonate of soda, 0·070088; bicarbonate of lithia, 0·001279; bicarbonate of ammonia, 0·000795; bicarbonate of lime, 0·547639; bicarbonate of baryta, 0·000367; bicarbonate of strontia, 0·000074; bicarbonate of magnesia, 0·297382; bicarbonate of protoxide of iron, 0·071386; bicarbonate of protoxide of manganese, 0·006677[1]; phosphate of alumina, 0·000460; alumina combined with silica, 0·000034; silica, 0·034456; free, that is to say, entirely uncombined carbonic acid, 2·818499. Present in this water, but in too small quantity for estimation, are:—Nitrate of soda, iodide and bromide of sodium, organic matter, and nitrogen, all mere traces. The author quotes in this, as well as in the immediately preceding paper, a very interesting series of analyses of other mineral waters, for the sake of comparison. Space forbids us to abstract or quote these particulars here; suffice it to say that the Lamscheid mineral water is a most excellent chalybeate, and quite equal to the celebrated chalybeate of Pyrmont.

Asparaginic and Glutaminic Acids.—Dr. Ritthausen.—Among the products of the decomposition by the action of strong sulphuric acid upon legumine and conglutine, the latter substance being the proteine compound met with in almonds and lupines, the author discovered asparaginic and glutaminic acids, and, moreover, a substance the nature of which has not been further investigated. In this essay, the investigation of this subject, commenced some time ago, is fully described. Asparaginic acid exhibits a crystalline body, belonging, in that respect, to the rhombic system, soluble in water and alcohol, and consisting, in 100 parts, of:—C, 36·09; H, 5·26; N, 10·53; O, 48·12. Formula, $C_8H_7NO_4$. This acid, which yields, with the oxides of copper and silver, and also with baryta, well-defined salts, is converted, by the action of nitric acid, into malic acid, $C_4H_6O_5$. Glutaminic acid, $C_5H_9NO_4$, when pure, also exhibits crystals belonging to the tetrahedric rhombic system; soluble in water and alcohol; converted into glutanic acid, $C_5H_8O_4$, by the action of nitric acid.

Asparaginic Acid as a Product of the Decomposition of Animal Proteine Compounds.—Dr. Kreusler.—This author has undertaken, for animal proteine compounds, an investigation of a similar nature as Dr. Ritthausen has done for vegetable proteine substances. The writer of this paper has applied, for his researches, caseine from milk, albumen from eggs, and vitelline from the same. These substances were treated separately with a mixture of 3 parts of concentrated sulphuric acid and 6 parts of water to 1 part of substance; the boiling was continued for eight hours. After the necessary purifying process, and the use of oxide of copper to form salts, the author discovered, with perfect certainty, that asparaginic acid is formed in this instance; but glutaminic acid could not be detected. Animal horn, when treated with sulphuric acid, also yields asparaginic acid.

Analysis of the Iodine Containing Water from the Mineral Spring at Roy, near Freistadt, Silesia.—Dr. Redtenbacher.—10,000 parts of this water contain:—Chloride of sodium, 219·680; chloride of potassium, 2·062; chloride of calcium, 21·384; chloride of magnesium, 7·740; bromide of magnesium, 1·016; iodide of magnesium, 0·319; carbonate of magnesia, 1·832; carbonate of protoxide of iron, 0·505; free carbonic acid, 0·594; silica, 0·554; organic matter, 0·432; total of solid substances, 251·6. The iodine spring at Halle contains:—Bromide of magnesium, 0·584; iodide of magnesium, 0·426. The iodine spring at Luhatschowitz contains:—Bromide of magnesium, 0·116; iodide of sodium, 0·237. For both these last springs, the quantities quoted refer to 10,000 parts of water.

Annalen der Physik und Chemie, von Poggendorff, No. 9, 1869.

The following are original papers in this number:—

New Spectroscope, and Contributions to the Spectrum Analysis of the Stars.—M. Zöllner.—The author describes what he calls a reversion spectroscope, and elucidates its mode of action by relating at length a series of observations made by him with this instrument.

Thermo-Chemical Researches.—M. Thomsen.—The basis of this lengthy essay is thus set forth:—Different acids, when neutralised with the same base, evolve unequal quantities of heat; when, therefore, any acid displaces another acid from its combination with that base, this decomposition will be accompanied, either by an evolution of heat or by an absorption of heat, according to the greater or less heat of neutralisation possessed by the free acid or the acid of the salt. The quantity of heat thus evolved or absorbed affords a measure for the degree of decomposition.

Combinations of Alcohol and Water.—M. Mendelejeff.—This paper contains a review of almost every point worthy of notice bearing upon the history of the accurate determination of the density, contraction, and areometrical assay of mixtures of water and alcohol at various temperatures. Another portion of this paper is an essay on the determination of the specific gravity of liquids; to this portion is added the description of a very ingeniously-contrived and neat apparatus, applied for the purpose of taking the specific gravity of liquids, illustrated by a woodcut.

Constant Capillarity of Fused Chemical Compounds.—M. Quincke.

Specific Heat of Air when Kept at a Constant Volume.—M. Witte.

Observations on the Chemical Constitution of Plagioklastic Felspar.—M. Tschermak.—The author does not explain the term *plagioklastic*, but he says the chemical composition of plagioklastic felspars is such that they exhibit isomorphous mixtures of two chemical compounds. [Our readers are reminded that felspar is a mineral of which there exists a great number of varieties; orthoklase, or potash felspar, is $KO,SiO_3+Al_2O_3,3SiO_3$.] The chemical composition of the varieties of this mineral oscillates between two extremes, viz.:—Albite, $Na_2Al_2Si_6O_{16}$, in 100 parts:—Silica, 68·6; alumina, 19·6; soda, 11·8. Anorthite, $Ca_2Al_4Si_4O_{16}$, in 100 parts:—Silica, 43·0; alumina, 36·9; lime, 20·1. The author, who is an eminent mineralogist, enters into a lengthy discussion on the mineralogical characters of felspars, and sharply criticises the labours of some other mineralogists; it appears, however, that the chemical analysis of minerals of complicated composition is not a matter of mathematical certainty. As a proof, the author quotes two analyses of the self-same identical substance, made by two noted chemists, wherein the difference of silica amounts to +2·30 per cent; alumina, −1·95 per cent; lime, +0·53 per cent; soda, −1·44 per cent.

Labradorite from the Närödal.—M. vom Rath.

Elements of Terrestrial Magnetism for Göttingen, July 9, 1869, and the Secular Variations.—M. Cohlrausch.—At latitude 51° 31′, 8 N., longtitude east of Greenwich 9° 56′, 6, the westerly declination of the magnetic needle was, on the above date, 14° 51′, 7; the inclination, 66° 47′, 4; horizontal intensity, 1·8412.

Reflection of Heat on the Surface of Fluor Spar and other Substances.—M. Magnus.—From this memoir we learn that the following substances reflect, at an angle of 45°, the undermentioned quantities of heat:—Silver, between 83 and 90 per cent; glass, between 6 and 14 per cent; rock-salt, between 5 and 12 per cent; fluor spar, between 6 and 10 per cent.

This number contains some papers which have been translated from the *Proceedings of the Royal Society*.

Moniteur Scientifique, October 15, 1869.

This number contains, among its original communications, the following:—

Manufacture of Alkaline Carbonates, and of Carbonate of Lead, and also other Carbonates, by means of a New Chemical Action.—M. Puissant.—When carbonate of baryta in finely-divided powder is suspended through water wherein, simultaneously, a proportional quantity of sulphate of soda is dissolved; and there is next passed through the liquid a current of carbonic acid, which is meanwhile brought to ebullition, double decomposition takes place, sul-

phate of baryta is formed, and carbonate of soda is found in the solution; this solution is filtered, and is employed, by means of a similar reaction, for the production of carbonate of lead. This is effected by the addition of sulphate of lead to this fluid, through which, while it is brought to ebullition, a current of carbonic acid is passed; in this manner, sulphate of soda is again formed, and carbonate of lead is deposited. It should, however, be understood that these reactions do not yield—(1) as regards carbonate of soda, that salt at a less cost than the process by which it is usually made; (2) that the carbonate of lead is neutral carbonate. and is not, therefore, possessed of the requisite covering quality of white lead, $3(PbO,CO_2),PbO,HO$, which is a basic carbonate of lead, which cannot even be made by passing into an aqueous solution of sub-acetate of lead, carbonic acid gas; unless, as is done by M. Ozouf, at St. Denis, near Paris, the quantity of the gas is exactly regulated so as to produce a given quantity of white lead. The two following formulæ exhibit the reactions above alluded to:—

$$BaO,CO_2 + NaO,SO_3 = BaO,SO_3 + NaO,CO_2.$$
$$PbO,SO_3 + NaO,CO_2 = PbO,CO_2 + NaO,SO_3.$$

Quantitative Analysis of Raw Soda (Soda Ash) and Caustic Soda.—M. Jean.—After referring to the volumetrical methods devised by the late M. Gay-Lussac, and pointing out some inconveniences of this method, the author states that he proceeds as follows:—Take 4 grms. of the sample to be analysed, and dry completely at from 110° to 120°; the difference between the weight of the quantity originally taken and the weight after drying gives the quantity of water. Take 1 grm. of this dried material, place it in a glass tube, and pass a current of dry carbonic acid gas over the substance for about an hour; dry it again at 110°, to drive off any mechanically-adhering carbonic acid; place the substance upon a filter, and exhaust with tepid water (32°), until the wash water is no longer precipitated by chloride of barium. The filtrate is collected in a glass balloon with flat bottom, and chloride of barium is added to it. The liquid is left to settle, and, on having become quite clear, is drawn off from the precipitate, by means of a pipette, and the precipitate of carbonate of baryta is collected on a tared filter, washed with boiling water, dried, and weighed. If there happen to be sulphates present, the sulphuric acid is precipitated, along with the carbonate of baryta, as sulphate of that base, and the weighed carbonate of baryta is, therefore, washed with water acidulated with hydrochloric acid, again washed with warm water, and, after drying, weighed. In order to estimate the carbonate of soda, 1 grm. of the dried sample is taken, dissolved in water, precipitated with chloride of barium, the precipitate is collected on a tared filter, and, after having been washed and dried, there is deducted, from the weight found, the weight of the sulphate of baryta. The difference of the weights of the carbonates of baryta found by these two operations indicates the quantity of carbonate of baryta which, by calculation, has to be converted into caustic soda; the second assay gives the quantity of carbonate of soda. In order to estimate the sulphide of sodium contained, 1 grm. of the dried material is again taken; this quantity is dissolved in water, and estimated according to M. Gay-Lussac's method. Let us suppose that this assay has given a quantity of carbonate of soda equal to A, and that our previous operations gave us B of caustic soda and C of carbonate of soda; calculate the quantity of caustic soda, B, into C′, as carbonate of soda—C′ + C = C‴, total quantity of carbonate of soda indicated by the gravimetrical assay. The difference between the quantity, A, of carbonate of soda indicated by the volumetrical method, and C‴, that found by the gravimetrical method, indicates the quantity of carbonate of soda which has to be calculated as sulphuret of sodium.

Preparation of the Sulphuret of Sodium by a New Process.—M. Jean.—After referring to the difficulties attending upon the preparation of sulphuret of sodium, by igniting a mixture of sulphate of soda and carbonaceous matter, whereby a pure product can never be obtained, the author states that he has found the following process to yield very satisfactory results:—25 kilos. of dry sulphate of soda, 75 kilos. of sulphate of baryta, 10 kilos. of powdered charcoal, and 15 kilos. of powdered pit-coal, are intimately mixed and ignited in an ordinary soda furnace. From time to time, a small sample of the ignited mass is taken, and tested by being dissolved in water, filtered, and to the filtrate a drop of a solution of sulphate of soda is added. As soon as a precipitate of sulphate of baryta ensues, the operation is finished, and the ignited mass is at once transferred to iron vessels, which can be closed with a lid, so that access of air is excluded while the mass cools down; after cooling, the crude sulphuret is placed in wrought-iron tanks, and boiling water is added and ebullition kept up for some time; some sulphate of soda is added, in order to precipitate excess of sulphide of barium. After the liquid has become clear, it is drawn off by means of a syphon, and the solution evaporated to dryness. The sulphuret of sodium obtained by this process is quite free from any undecomposed sulphate, from sulphuret of iron, from silica, and from alumina. By this process, the fire-bricks of the furnace are not acted upon, and the ignited mass is in pulverulent, and not in fused state, and therefore no grinding is required. When, instead of sulphate of soda, sulphate of potassa is used, an excellent sulphide of potassium is obtained, which would be greatly in demand for the manufacture of ferrocyanide of potassium by Géli's process, and for the artificial preparation of water impregnated with alkaline sulphides to be used for bathing purposes.

Purifying Bromide of Potassium.—Dr. Baudrimont.—The bromide of potassium is first qualitatively tested for the presence or absence of iodide of potassium; if that salt happen to be present, it is removed in the following manner:—About 10 grms. of the impure bromide are dissolved in a sufficient quantity of distilled water; a solution of bromine in water is then added in excess, this solution being preferable to bromine itself, as being more readily managed. The liquid is then heated to boiling, and kept so until no more vapours of iodine are given off. The liquid is next evaporated to dryness, in order to eliminate the excess of bromine. In this way a bromide of potassium is obtained free from iodide, but which may yet contain chloride of potassium.

Annales de Chimie et de Physique, October, 1869.

This number contains the continuation of an essay—

New Researches on Thermo-Chemistry.—M. Berthelot.—This paper is divided into several sections, each bearing a separate title:—Decomposition of organic substances by heat; action of the electric spark upon marsh gas; union of nitrogen in free state with acetylen; direct synthesis of hydrocyanic acid; formation and decomposition of sulphide of carbon; chemical equilibrium between carbon, hydrogen, and oxygen; the spectra exhibited by some compound substances when exposed to gaseous mixtures in state of equilibrium; influence of pressure upon chemical equilibria, and especially on the reactions taking place between carbon and hydrogen.

Memoir upon the Determination of the Lengths of the Waves of the Metallic Spectrum Rays.—M. R. Thalén.

Second Memoir on Supersaturation.—M. Lecoq de Boisbaudran.—This paper is the first instalment of a second memoir of the subject named at the head. The author says—"I intend to divide this essay into two sections; in the first of these, I shall record the action of some isomorphous substances upon the supersaturated solutions of the sulphates of the oxides of iron, nickel, copper, cobalt, magnesia, and zinc; in the second portion of this essay will be found described the action of the same isomorphous substances upon supersaturated solutions of two of the above-named sulphates at the same time.

Revue Hebdomadaire de Chimie, October 7, 1869.

This number contains:—

Description of an Air-Pump with Free Plunger.—M. Deleuil.—There is added to this paper a well-executed woodcut. It appears that the vacuum which can be maintained by this air-pump is more perfect than has hitherto been obtained by any ordinary pump of the sort. From recipients of 250 litres capacity, the air can be withdrawn so as to leave only 10 m.m. pressure in a quarter of an hour. There is, with this machine, no need for the use of any oil to counteract friction. The piston (plunger) is double-acting, and it moves as easily at the beginning of the operation of pumping as at the end, with a very rarefied air. The free space between the plunger and the body of the pump is only 1-50th of a m.m.

October 14, 1869.

This number contains:—

Use of Electric Alarums to Indicate a Certain Temperature. MM. Besson and Knieder.—The authors have constructed a set of thermometers, through the tubes of which are soldered two small pieces of platinum wire, which are not in metallic contact, until the mercury just rises to the height at which the wires have been placed. Since the latter are in contact with conducting wires to a suitable galvanic apparatus, the instant the mercury makes metallic contact, an alarum is sounded; and this may, of course, by proper adjustment, be affected at any temperature, which, for some purpose or other, should not be exceeded. The instrument is intended for industrial use.

Glycerine Soap.—M. Heeren.—Take 100 parts of oleine of commerce, pour it either in a glass flask (when only a small quantity of soap is intended to be made, or in a cauldron for large quantities), add 314 parts of glycerine of 1·12 specific gravity, heat to 50°, and then add 56 parts of an aqueous solution of caustic potassa (sp. gr., 1·34), and stir the mixture well. The soap is readily and rapidly formed; but the liquid has to be kept at rest for twenty-four hours, and then exhibits a mass of the consistency of honey, in which state it remains. Filtration may be required, but is troublesome and slow.

Test for Albumen.—Dr. Méhu.—Take of crystallised carbolic acid, one part by weight; of commercial acetic acid, the same quantity; of alcohol at 90 per cent, two parts; mix, and keep in a bottle. This fluid is intended to detect albumen in urine; and for that purpose, to 100 grms. of this liquid (urine) are added 2 c.c. of commercial nitric acid, and next, after thorough mixing, 10 c.c. of the carbolic acid solution. The reaction is stated to be very superior to the use of nitric acid alone.

Cosmos, October 16, 1869.

Liqueur de la Grande Chartreuse.—Dr. Chevalier.—According to this author, this celebrated liqueur, made at the Abbey of the name, near Grenoble, is composed of:—Essence of *melissa citrata*, 2 grms.; essence of hyssop, 2 grms.; essence of angelica root, 10 grms.; essence of best mint, 20 grms.; essence of nutmeg, 2 grms.; essence of cloves, 2 grms.; and 2 litres of rectified spirits of wine, of best quality. The liquid is artificially coloured, either with turmeric or any other suitable material.

Les Mondes, October 14, 1869.

Biography of A. von Humboldt.—M. C. Bruhns.—The Director of the Royal Observatory at Berlin has stated that he intends to publish a scientific biography of von Humboldt, with the co-operation of a great

number of German *savants*. The first portion of this work is entrusted to M. Lallemand, who has in his possession a large number of documents and manuscripts, never before published, relating to the late *savant*'s life. The second portion of this work will consist of eight separate chapters, each treating of a peculiar science; and each chapter will be edited by the most eminent men in the department of science it treats of.

Removing Stains caused by Photographic Chemicals from the Hands.—M. Fortin.—Referring to the use of cyanide of potassium, and of iodide of potassium, and iodine for this purpose, the author says the first endangers health, and even imperils life; the second is very expensive. The author recommends, instead, to wash the hands with a concentrated solution of either sulphate or chloride of zinc, to which some acid is added at the same time. The deepest and blackest stains should be touched with metallic zinc, whereby the reduction of the oxide of silver or that of the gallate of iron is promoted, and all metallic stains adhering to, or penetrating in the skin removed. Since most of the salts of zinc are colourless, and soluble in water, the hands become soon quite clean. They should then be washed, first with pure water, and next with soap and water.

Preparation of Caustic Baryta for Industrial Purposes.—M. Nicklès.—Four operations are required:—(1) Conversion of native sulphate of baryta into sulphide of barium is effected in a continuous manner, in a peculiarly-constructed furnace, the sulphate being previously mixed with a reducing substance; (2) the conversion of the sulphide of barium into hydrate of baryta by means of hydrated oxide of zinc; (3) dehydration of the hydrate of baryta by ignition along with saw-dust; (4) regeneration of the substance which has served for the desulphuration of the sulphide, and obtaining of sulphur.

Cultivation of Cotton in Southern France.—M. Croze-Mugnan.—The author states that, after having made a series of experiments for several years, he is convinced that the cultivation of the *Gossypium herbaceum* will be attended with excellent success in the warmer districts of the south of France.

New Theory of Gravitation.—M. Leray.—We only give the title of this paper, which is well worthy the notice of natural philosophers.

We learn from this paper that the Physical Society at Rotterdam, known as the Bataafsch Genootschap voor Natuur Schei en Werktuigkunde, has caused a number of medals to be struck to commemorate the hundredth anniversary of its existence. This medal, which is stated to be excellently well-made, bears upon the obverse the inscription, "Certos fetet Experientia Fructus;" upon the reverse, "Societas Philosophiæ Experimentalis Batava Roterodami Centesimum Natalem Celebrans. In Memoriam Stephani Hoogendijk, Fundatoris, MDCCLXIX—MDCCCLXIX." This Society has a large and very valuable collection of physical instruments, a fine library, and holds its meetings and lectures in the very extensive second-floor halls of the Royal Exchange at Rotterdam.

October 21, 1869.

New Process for Concentrating and Utilising the Sun's Rays.—M. Delaurier.—The author proposes, for this purpose, a truncated cone, open at both ends, and lined inside with polished silver, the sun's rays being admitted by the largest opening. Since the angle of reflection is equal to the angle of incidence, all direct, or reflected rays, will be united at the narrower end of the cone. It is clear that, the greater the length of the cone, the less the opening of its top need be, and the greater will be the concentration of heat. The author's paper, to which a woodcut is added, enters into a discussion on the advantage of this contrivance above the use of lenses and mirrors; and the author very enthusiastically surmises that the heat of the sun's rays may be so concentrated as to serve, instead of the combustion of fuel, for various purposes, especially in countries where, as in Algeria, the heat and splendour of the sun is more permanently felt.

Ancient and Modern Industry of the Chinese Empire.—Among the *accusés de reception*, we find, under the above heading, "d'Après des Notices Traduites," par M. Stanislas Julien, et accompagnées de notices industrielles et scientifiques, par M. Paul Champion, Préparateur de Chimie au Conservatoire des Arts et Métiers, Ancien Déléqué de la Société d'Acclimatation en Chine et au Japon; 1 vol., large octavo, 254 pages, and 13 lithographic plates. This is an authentic work, having been faithfully translated from the Chinese language by the best scholars versed in that language in France, while M. Champion has been residing a long time in China, and describes what he has actually seen. The work embraces the following subjects:—Fuel, salt, lime, sulphur, talc (magnesia minerals), nitrate of potassa (saltpetre), gunpowder, soda and potash, mineral pigments, alum, metals, vegetable colours and dye materials, vegetable wax (from trees), varnishes, oils, candles, ink, paper, printing, vegetable textile fibres, washing of garments, tobacco, papaver and opium, sugar, glucose, preservation of eggs, alimentary *regime* and wages, matches, amber, camphor, rearing of fish, magic lantern, boring of wells, silk, and some minor subjects. The entire work is full of extremely useful information, even for civilised Europe.

NOTES AND QUERIES.

Tungstate of Soda, &c.—Can any of your readers give us the names of manufacturers of tungstate of soda and tungstate of chrome?—J. C.

Bichromate of Potash.—Can any of your numerous readers inform me if bichromate of potash is manufactured anywhere else except in Scotland?—Bichrome, Glasgow, October 27, 1869.

Detection of Prussian Blue in Black Ink.—Can any of your readers kindly inform me how to detect Prussian blue in black ink, that is, if any has been used to give it a blue colour; and also if there is a means of telling when there is logwood used in the preparation, or galls.—J. Kaye.

Footpaths.—I wish to lay down a cheap footpath. Can any of your readers inform me of a compound that will harden and not be affected by the weather? I was thinking of using a mixture of tar pitch, sand, and gravel. What can I add to prevent it softening with the heat of the sun, if there is nothing cheaper, will cement do it? and if so what proportion must be used? Many of the streets in Paris are made with a compound put down in the form of powder, which after having been rolled with heavy rollers, becomes very hard, and forms a smooth and durable road. What is the mixture used?—Roadway.

Purification of Glycerine.—M. Kunath.—The glycerine used largely in those parts of Central Europe where the winters are severe for the filling of wet gas-meters has to be purified again, and concentrated after it has been in use for some time. For this purpose, the impure glycerine is poured in a large vessel, and, upon every hundredweight of glycerine, 10 lbs. of iron-turnings are added; the whole mass is thoroughly stirred up, and this stirring repeated for some hours every day for a fortnight. After that period, the mixture is left quietly standing for some weeks, when the clear liquid is withdrawn from the sediment by means of a syphon, concentrated by evaporation, and again used in the gas-meters. The iron-turnings act mechanically as well as chemically: sulphuret of iron is formed, and the formation of this substance aids the precipitation of tarry matters.—*Dresdener Gewerbe Vereins Zeitung*.

Rendering and Bleaching Tallow.—Will any of your practical correspondents kindly give me the best and cheapest methods of rendering and bleaching tallow from rough fat, and how much per cent of tallow should be realised from rough fat rendered by the aid of sulphuric acid (say about 1 per cent of acid); or is that quantity of acid too much, as I find a great variation in the quantity obtained from present results; the quantity of rough fat rendered at each operation is about 3 tons. Is bleaching with black oxide of manganese and sulphuric acid considered the best, or a good method? as I find, in practice, it gives a yellow tinge—occasionally. What may be the cause? as I cannot get the tallow as white as it ought to be; it is more like beef tallow, although it is rendered from a mixture of beef and mutton fat. What substance can be used to precipitate impurities arising from rendering and bleaching when the process of washing is going on? Also, is there any method that can be used to prevent tallow *seeding* (a term generally used in the trade, which denotes the separation of the oily portion from the solid parts), besides continual agitation, until sufficiently cold to be packed?—A Tallow Melter.

MEETINGS FOR THE WEEK.

Thursday, November 4th.—Chemical Society, 8. Discussion on Dr. Williamson's Discourse "On the Atomic Theory."

TO CORRESPONDENTS.

Erratum.—Page 201, column 1, bottom line, insert, after 120 c.c., the word *aniline*.

Ferrum.—Please forward your address.

BOOKS RECEIVED.

Exercises in Practical Chemistry, by A. G. V. Harcourt, F.R.S., and H. G. Madan, F.C.S.

Chemistry: General, Medical, and Pharmaceutical, including the Chemistry of the British Pharmacopœia. By John Attfield, Ph.D. London: John Van Voorst.

A Pharmacopœia, including the Outlines of Materia Therapeutics, for the use of Practitioners and Students of Veterinary Medicine. By Richard Tuson, F.C.S., &c. London: John Churchill and Sons.

Just published, demy 8vo., price 6d.

On English and Foreign Alkalimetrical and Chlorimetrical Degrees, by John Pattinson, F.C.S. Read before the Newcastle Chemical Society.

London: Chemical News Office, Boy Court, Ludgate Hill, E.C.

Professor Tennant, F.G.S., will deliver a Course of Lectures on MINERALOGY applied to GEOLOGY and the ARTS, at King's College, London, on Wednesday and Friday mornings, at nine o'clock, during October, November, and December, commencing October 8th. Fee, £2 2s.

A Course of Lectures on MINERALOGY and GEOLOGY will also be delivered, on Thursday evenings, at eight o'clock. These begin October 14th, and will be continued to Easter, 1870. Fee, £1 11s. 6d. Professor Tennant gives Private Instruction in Mineralogy and Geology, Illustrated by a large number of Specimens, at his Residence, 149, Strand, W.C.

THE CHEMICAL NEWS.

VOL. XX. No. 519.

ON THE

METHODS OF ANALYSIS AND THE COMPOSITION OF VARIOUS CHEMICAL MANUFACTURING PRODUCTS.

By M. GASTON TISSANDIER.

(Continued from p. 93.)

SULPHATES OF POTASH.

ALMOST all commercial sulphates of potash are obtained from beet-root salts, or by treating the ashes of seaweed. All specimens, whatever their origin, may, however, be analysed in the following manner.

Mode of Analysis.—Weigh 25 grms. of the sulphate in question, and dissolve in distilled water; filter, to separate the insoluble substances, and wash the filter until the clear liquid, collected in a graduated measure, occupies the volume of 500 c.c.

Alkalimetric or Acidimetric Standard.—Plunge sensitive litmus paper into the solution, and ascertain whether it be alkaline or acid. In the first case, take the alkalimetric standard in 100 c.c. In the second, which is less frequent, obtain the acidimetric standard by means of a standard potash solution.

Sulphuric Acid.—The sulphuric acid is estimated in 10 c.c. of the solution (0·5 grm.), by means of chloride of barium.

Chlorine.—Determine the proportion of chlorine in 50 c.c. (2·5 grms.) by standard nitrate of silver.

Potassium.—To estimate this exactly, add to 10 c.c. of the solution a few drops of chlorhydric acid and of a standard solution of chloride of strontium, in such quantity that all the contained sulphuric acid may be precipitated in the state of sulphate of strontia. Let it stand for twelve hours; filter, and, after washing the precipitate, evaporate the filtered liquid almost to dryness. Add a slight excess of bichloride of platinum, and evaporate with the precipitated chloroplatinate of potash, which must be collected and weighed, as directed under the article "Salts."* The transformation of the sulphate into chloride by the chloride of strontium is indispensable, if an exact result be desired. Were the bichloride of platinum added directly to the solution of the sulphate, the potash would not be entirely precipitated; the precipitated chloroplatinate would contain, as has been already proved, a certain proportion of non-decomposed sulphate.

Moisture.—The salt is dried on a stove, at 110°, or in a platinum crucible.

Calculation of the Analysis.—The potassium found is converted into sulphate of potash, and it is seen by calculation if the quantity of sulphate of potash so formed contains the proportion of sulphuric acid found. If there is an excess of sulphuric acid, it is converted into sulphate of soda. If, on the other hand, the quantity of potassium is too considerable to saturate the whole of the sulphuric acid, the excess must be combined with chlorine and carbonic acid. Some sulphates contain chlorhydric acid. Its presence may be accounted for by the addition of sulphuric acid in the manufacture. The sulphuric acid is used to transform the carbonate of potash into sulphate, but, if added in too great excess, it will act upon the chloride of potassium, and give rise to an equivalent quantity of chlorhydric acid.

* CHEMICAL NEWS, vol. xx., p. 73.

COMPOSITION OF COMMERCIAL SULPHATES.

I. Sulphates obtained from Beet-root Salts.

Matters estimated.	I.	II.	III.	IV.	V.
Moisture	5·61	4·47	1·99	1·61	3·11
Insoluble matter	0·22	0·41	1·18	0·42	0·16
Chloride of potassium	2·77	1·72	1·61	1·68	1·20
Sulphate of potash ..	85·80	91·08	92·50	93·79	91·20
Carbonate of potash ..	3·00	2·60	2·72	2·41	4·11
Carbonate of soda ..	2·60	—	—	—	—
Non-estimated and loss	—	0·20	—	0·09	0·22
Total	100·00	100·00	100·00	100·00	100·00
			M. A. Lefebvre, Corbehem, near Douai.		M. Dronlers, Aseq, nr. Lille.

II. Sulphates obtained in the Manufacture of Iodine.

Matters estimated.	I.	II.	III.	IV.	V.
Moisture	3·99	2·02	1·22	4·21	1·01
Insoluble matter	0·29	0·20	0·10	0·19	0·12
Chloride of sodium ..	7·12	8·72	1·32	1·66	5·80
Sulphate of potash ..	75·84	75·12	75·62	77·00	82·69
Sulphate of soda	11·45	12·81	21·12	16·22	9·35
Carbonate of soda ..	0·80	0·71	0·62	0·72	1·03
Non-estimated and loss	0·51	0·42	—	—	—
Total	100·00	100·00	100·00	100·00	100·00

CAUSTIC SODA.

Specimens of commercial caustic soda generally present the appearance of greenish or yellowish masses, which must be quickly crushed into small fragments before analysis. For this purpose, it is best to employ a cast-iron mortar, perfectly clean, and previously warmed, in order that the soda may not absorb atmospheric moisture in any appreciable quantity during the crushing. Commercial caustic sodas always contain chloride of sodium, sulphate and carbonate of soda. The method by which the exact proportion of these constituent elements may be ascertained will now be shown.

Total Alkalimetric Standard.—Weigh 5 grms. of caustic soda quickly, and dissolve them in water. Take the alkalimetric standard in the cold, by means of ordinary standard sulphuric acid. The total standard of caustic soda is sometimes from 108° to 110°.

Estimation of Caustic Soda.—Weigh 5 grms. of caustic soda, and throw them into a stoppered flask containing about 400 c.c. of water: distilled water, previously boiled, to avoid its containing carbonic acid, is the best. When the soda has been dissolved by stirring, add an excess of chloride of barium, which will precipitate the sulphate of soda as sulphate of baryta, and the carbonate of soda as carbonate of baryta. The liquid thus formed must be filtered, care being taken to close the flask as much as possible, and to cover the top of the filtering funnel with a plate of glass, to avoid the action of the air. It is especially needful to place the funnel in a flat-bottomed flask, that the filtered liquid may not come in contact with the ambient air. Litmus is added to the filtered liquid, and the alkalimetric standard taken in the cold. The addition of normal sulphuric acid solution causes the formation of a precipitate of sulphate of baryta, due to the excess of chloride of barium; but this occurrence is of no importance. The number of divisions on the burette must be read at the exact moment when the last drop of standard liquid causes the solution to change from violet-blue to vinous-red. This number gives the standard of causticity, which, again, shows, by calculation, the quantity of caustic soda according to the following equation:—

$$\frac{\text{Standard or number of divisions on the burette}}{x} = \frac{40(SO_3HO)}{40(NaO,HO)}$$

The standard of causticity obtained, deducted from the total standard, gives the standard corresponding to the carbonate of soda, and, consequently, the proportion of

the latter salt. To be more exact, this determination should be verified in the following manner.

Carbonate of Soda.—The filter containing the sulphate and carbonate of baryta will also serve to determine the quantity of carbonate of soda. Pour upon the filter water acidulated with pure chlorhydric acid, which will dissolve only the carbonate of baryta, without acting at all upon the sulphate. The filtered liquid contains, in the state of chloride of barium, all the baryta of the carbonate of baryta. Sulphuric acid is now added, and, after standing for twelve hours, the precipitated sulphate of baryta is weighed. This sulphate of baryta is transformed, by calculation, into carbonate of baryta; or, directly, by equivalents, into carbonate of soda; and thus the quantity of the latter salt contained in 5 grms. of caustic soda is ascertained.

Sulphate of Soda.—The amount of sulphuric acid in caustic soda is estimated in 5 grms. of the specimen under analysis, by means of chloride of barium (see article, "Salts" *ante*). If it be desired to omit this experiment, the filter used to obtain the standard of causticity may be immediately weighed, after rinsing with chlorhydric acid, to remove the carbonate of baryta. In this case, in order that the estimation may be exact, the precipitate of carbonate and sulphate of baryta must be allowed to stand for twelve hours.

Chloride of Sodium.—Weigh 2·5 grms. of caustic soda, and throw into a stoppered flask; dissolve it in water, acidulate with pure nitric acid, and estimate the chlorine with the standard nitrate of silver liquid (see article, "Salts," *ante*).

Moisture.—The moisture contained in caustic soda is estimated by operating in a silver crucible, which must have a cover. It is weighed empty, and again weighed with a small quantity of caustic soda. Heat is carefully applied to fuse the soda: great precaution must be used that the temperature may not be too much increased, in order to avoid projections. The action of too much heat would not only remove the moisture, but also part of the water in combination with the caustic soda, and the erroneous figure thus obtained would be, in that case, much too high. The caustic soda, once fused, is again weighed, and the three weights thus obtained are the bases of a simple calculation, which will give the quantity of humidity contained.

Calculation of the Analysis—Some of our readers have asked for more ample details respecting the calculations necessitated by these modes of analysis. We will, therefore, re-produce an example of the analysis of caustic soda.

Direct Results of an Analysis of Caustic Soda.

Total standard, 109°.

Standard of causticity, 106°.

Number of divisions of the graduated burette of nitrate of silver (estimation made on 2·5 grms.), 101 divisions.

Weight of the sulphate of baryta in 5 grms., 0·195 grm.

By deducting the standard of causticity from the total standard, the standard of carbonate of soda is obtained. Say, 109 − 106 = 3. To obtain the quantity of carbonate of soda corresponding to a standard of 3 degrees, it is only necessary to state the following equation:—

$$\frac{3}{x} = \frac{49(SO_3HO)}{53(CO_2NaO)}$$

Whence x (carbonate of soda) = 3·44 per cent.

The standard corresponding to the caustic soda is 106°. Consequently,

$$\frac{106}{x} = \frac{49(SO_3,HO)}{40(NaO,HO)}$$

will give x (hydrated caustic soda) = 86·53 per cent.

Commercial caustic soda is generally sold according to the quantity of anhydrous soda, NaO. To obtain NaO, state the equation—

$$\frac{86{\cdot}53}{x} = \frac{40(NaO,HO)}{31(NaO)}$$

Whence x (NaO) = 67·306 per cent,

For the chloride of sodium, the standard liquid containing nitrate of silver in such a quantity that one division corresponds to 1 milligramme of chlorine, state the equation—

$$\frac{101}{x} = \frac{35{\cdot}5(Cl)}{58{\cdot}5(NaCl)}$$

Whence x = 1·66. But 2·5 grms. were operated upon; it is, therefore, necessary to multiply by 40 to obtain the quantity of chloride of sodium in hundredths.

1·66 × 40 = 6·64, or ClNa = 6·64 per 100.

The sulphate of baryta, in 5 grms., weighs 0·195 grms. Consequently, the equation—

$$\frac{0{\cdot}195}{x} = \frac{116{\cdot}5(SO_3BaO)}{71(SO_3,NaO)}$$

will give x = 0·118 × 20 = 2·36 of SO_3NaO per cent.

The analysis is thus formularised, after estimating the moisture, which we will suppose to exist in the specimen under analysis in the proportion of 1·02 per cent.

Moisture	1·02
Chloride of sodium	6·64
Sulphate of soda	2·37
Hydrated caustic soda	86·53
Carbonate of soda	3·44
	100·00

Oxide of sodium (NaO) = 67·306 per cent. We have omitted the calculation relative to the determination of the carbonate of soda by the carbonate of baryta, as it is sometimes unnecessary. Supposing the above analysis to have been scrupulously exact, the carbonate of baryta dissolved in pure chlorhydric acid, and precipitated as sulphate of baryta, would yield a weight of 0·379 of sulphate of baryta.

$$\frac{0{\cdot}379}{x} = \frac{116{\cdot}5(SO_3BaO)}{53(CO_2NaO)}$$

would give x = 0·172 as the quantity of carbonate of soda contained in 5 grms. Multiplying by 20, the product would be—Carbonate of soda = 3·44 per 100.

Composition of Caustic Sodas.

Matter estimated.	I.	II.	III.	IV.	V.	VI.
Moisture	4·38	3·31	3·71	0·59	0·68	1·11
Chloride of sodium	11·32	12·22	3·90	7·43	6·89	5·60
Sulphate of soda	3·41	2·00	2·60	1·00	1·32	2·10
Carbonate of soda	5·58	9·82	3·69	3·45	3·68	5·48
Caustic soda (NaO,HO) ..	75·21	72·65	86·10	87·73	87·50	85·71
Total	100·00	100·00	100·00	100·00	100·00	100·00
Oxide of sodium (NaO) p. 100	58·10	56·30	66·67	68·00	67·80	66·42
	French sodas.			English sodas.		

Sodas of a much poorer quality than those whose composition we have just given are occasionally to be met with. We subjoin an example of the analysis of one of these poorer caustic sodas. Caustic sodas are generally sold according to the quantity of anhydrous oxide of sodium (NaO); and the analyses are usually formularised in the above manner. It will be seen from the above figures that the products of English manufacture are much richer than the French. Some few French manufacturers have already brought the production of caustic soda to perfection; but much progress still remains to be realised in France with respect to this manufacture.

Composition of Very Poor Caustic Soda.

Matter estimated.	I.	II.	III.
Moisture	1·01	0·92	0·99
Chloride of sodium	18·86	19·76	17·47
Sulphate of soda	7·42	3·09	2·36
Carbonate of soda	6·48	34·63	38·37
Hydrated caustic soda	66·12	41·60	40·81
Total	100·00	100·00	100·00
Oxide of sodium (NaO) per 100 ..	51·24	32·24	31·60

(To be continued).

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 209.)

THE microscopist, in the course of his studies, will find a very large class of substances for which the processes described in the preceding chapter are of no avail, owing to the impossibility of drying them without materially affecting their structure. The preservation of such substances has always been a matter of some trouble; and beginners are frequently deterred from attempting the processes of fluid mounting by supposing that the difficulties are of an insurmountable kind.

There is also a prejudice against objects mounted in fluid, owing to their supposed want of durability. There is, no doubt, some ground for this objection if the ordinary fluid-mounted objects only are considered. These are of necessity manufactured cheaply and in large numbers, and but little care can be bestowed upon their preparation. But, if the cabinets of our best manipulators are examined, the evidence will be found rather in favour of than against fluid mounting, provided care be taken to adopt the best processes, and carry them out carefully; the causes of failure being rather attributable to bad workmanship than to defects in the mode of preparation. Instances are on record of objects mounted in fluid as long ago as twenty years being still in good preservation.

The subject naturally divides itself into two parts; the processes connected with the enclosing of the object in its cell, and the consideration of the nature of the fluid media employed as preservatives.

The object to be mounted in fluid will nearly always require some previous preparation, excepting in those cases where it is free from included air, and the fluids contained in its tissues are readily miscible with the preservative employed. This preparation consists in keeping the tissues required for preservation immersed either in the fluid in which they are to be mounted, or some other which is capable of combining with it without injurious chemical change. This soaking will occasionally occupy a considerable time; but it may be materially expedited by making use of the air-pump, which will ensure the saturation of the tissue, and assist in the removal of air that may be held within it. The process is exactly the same as that adopted on the large scale for the preservation of railway-sleepers, by impregnating them with creosote; and, in another operation (one that more closely approaches the subject under consideration), Manfield's patent for making pickles, in which the vegetables to be treated are saturated in a few minutes with vinegar, by being submitted to its action in a vessel from which the air has been exhausted; a process which took so long a time in the ordinary way, that manufacturers, to save the loss of capital involved in using vinegar, employed brine, which was afterwards removed by strong acetic acid, greatly to the detriment of the resulting manufacture, both as to flavour and wholesomeness. This is now obviated by the new process, the pickles produced by which closely resemble those made at home.

Although the air-pump is useful where sub peculiarly liable to retain air (such as larg tomical preparations) are being operated u use can generally be dispensed with for o purposes, a prolonged soaking being sufficient cases.

In mounting an object in fluid, a cell of s size and depth is to be selected, and care tak it is properly cleaned. It is then filled w mounting fluid, and should be rather over tha filled. The object is now placed in the cell, circumstances have rendered it advisable th should be done previously. The preparation, stage, should be carefully examined, with a the detection of air-bubbles. They are esp liable to adhere to the lower part of the cell, it joins the glass slide. They are best dislod drawing the point of a needle round the int the cell. Floating bubbles may be broken, moved by lightly touching with a pointed fr of blotting-paper.

The cover glass is to be placed upon the directed in balsam mounting—letting one edg the cell first; and, as in that process care wa to keep everything dry, in fluid mounting we adopt the opposite course of treatment. To the adhesion of the mounting fluid to the cov lessen the chance of including an air-bubbl well to moisten the cover by breathing on before placing it on the cell.

The surplus fluid is best removed, in the stance, by drawing it off with a curved and pointed pipette, made in the form of an ordinar pipe. The use of this contrivance will generall the floating cover to be brought in contact w top of the cell without the risk of flooding its surface, which is nearly sure to take place wh cover is pressed down suddenly, and will give to remove when viscid fluids like glycerine are used. When as much of the fluid is rem can be conveniently taken up with the pipe rest is absorbed by the careful use of fragm blotting-paper. Care must be taken not to this process too far, as, if too much of the absorbed, an air-bubble may enter, which will sitate the removal of the cover and a repet the operation. The moisture being cleaned outside, the cell is ready to receive its first varnish, which is to be applied with a small and care should be taken to fill the angle contact of the cover and cell, and to include ring of varnish a small portion of the edge cover. This first coat of varnish must be pu hand, as the adhesion of the cover is too s bear the action of the turn-table, which m however, may be employed with advantage in on the second and subsequent coats, as, by i greater neatness and rapidity are attained th possible by painting on the varnish by hand.

The best and most durable cement for s the covers of objects mounted in fluid is the known as japan gold-size, the principal con of which is boiled linseed-oil. It is easily ob at any varnish shop. It is best kept for us collapsible tubes recommended for holding balsam. If kept in a bottle, it absorbs air, th and loses, to some extent, its drying pro This varnish is remarkable for its elastici toughness when dry, which may readily be by scraping a portion, which will be four

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January —April, 1869.

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tice of fluid mounting, it
student to make his first
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of fluid mounting forms
tion by Mr. T. C. White to
lub (*Journal of the Quekett*
, 147). He forms a cell
by dissolving gum damar
holding a brush charged
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rn-table, and the slide is
oubt be more secure if

finished with a few coats of gold-size. This process can only be used by those who are somewhat expert, as, should the first attempt fail, the cover cannot be removed and the process repeated. It is a very expeditious mode of mounting, and is likely, in some cases, to prove of great value. Mr. White states that he has had slides mounted for two years which are still perfectly sound and free from air-bubbles. The solution of damar may also be used as a very efficient substitute for the mixture of balsam and benzol. It is, like most varnishes, rather troublesome to make, as, owing to the impurities usually contained in the gum, the varnish requires straining; a somewhat difficult matter with so volatile a solvent as benzol.

(To be continued.)

VOLUMETRIC SOLUTIONS FROM WHICH THE PERCENTAGES MAY BE READ OFF IN THE NUMBER OF VOLUMES REQUIRED.

By WATSON SMITH, F.C.S.

The great advantage to commercial analysts of a method of constructing volumetric solutions from which the percentages may be read off in the number of volumes of such solutions required, or ascertained by a very simple calculation which can be mentally performed with ease, is, I think, palpable. The following is an outline, with examples of the methods of calculation required in titrating these solutions:—

For the sake of brevity, let x = weight of body taken, in which it is required to find the percentage of l; let n = number of volumes of solution required, and *p.c.* stand for percentage.

1st. Solutions from which the *p.c.* may be read off directly, or *p.c.* = n.

The solution is so made that the weight of l, to which each 100 volumes is equivalent, = x; or, in other words, the solution is so made that 100 vols. thereof shall just be equivalent to the amount of l in the weight, x, of the body, supposing it to contain 100 *p.c.* of l.

From the foregoing, it will be seen that, for each solution, x must be a constant weight, in order that the percentages may be obtained in each special manner.

Now, by way of verification, let $x = 10$.

α. Then each volume of solution must be equivalent to 0·1 l or 100 vols. = 10 l.

And, say, 55 vols. of solution have been required in an experiment, then the body contains $\frac{55 \times 0{\cdot}1 \times 100}{10} = 55$ *p.c.* of l.

β. Let $x = 4{\cdot}4$. Each volume of solution must = 0·044 l (100 vols. = 4·4 l); and, say 55 vols. of solution have been required, the body contains $\frac{55 \times 0{\cdot}044 \times 100}{4{\cdot}4} = 55$ *p.c.* of l.

As practical examples, take the following:—

a. It is required that the *p.c.* of NH_3 in a sample of ammonium sulphate be ascertained. Let 5 grms. = x (see Chemical News, Notes and Queries, vol. xx., p. 168); then the acid solution (say hydrochloric) must be made so that each c.c. is equivalent to 0·05 grm. of NH_3 = 0·091 grm. Na_2O.

This is done by weighing out $\frac{106 \times 2{\cdot}5}{132} = 2{\cdot}008$ grms. of sodic carbonate (pure and freshly-ignited), and making the acid so that 50 c.c. thereof are just sufficient to neutralise this 2·008 grms.

A *sodic-carbonate* solution must now be made, exactly equivalent to the acid solution; *i.e.*, 100 c.c. must contain $\frac{5 \times 106}{132} = 4{\cdot}015$ grms. of Na_2CO_3, or 40·15 grms. per litre. Therefore, 40·15 grms. of pure freshly-ignited sodic-car-

bonate must be weighed out, dissolved in pure distilled water, and diluted to 1 litre.

Now, supposing the NH_3 has been distilled off, from the weight of sulphate taken, into 24 c.c. of the HCl solution, and 3·5 c.c. of sodic carbonate solution have been required to neutralise the excess of HCl, then 24 − 3·5, = 20·5 *p.c.* of NH_3 are contained in the sample of sulphate.

b. Again, a convenient "test acid" for estimating the *p.c.* of soda in samples of sodic carbonates and hydrates may be made as follows :—Dilute a quantity of sulphuric acid with about its own bulk of water, and let stand till cold; then further dilute till a Twaddell's hydrometer marks in it 10½° (which indicates about the sp. gr. of the required acid). 5 grms. of pure freshly-ignited sodic carbonate are now weighed out, and the acid is so adjusted that 58·5 c.c. are just required for neutralisation. (NB. Pure Na_2CO_3 contains 58·5 Na_2O.)

2nd. Solutions of decimal strength, or in which *p.c.* = $n \times 0{\cdot}1$.

Where the reagent from which the volumetric solution is to be made is expensive, and the percentages happen to be low, a more dilute liquor is used, and thus a smaller weight, to represent x, is to be taken. Thus, for example, a convenient silver solution, for the determination of the *p.c.* of NaCl in samples of salt-cake, may be made as follows :—

Let x = 2 grms. Make the nitrate of silver solution of such strength that each c.c. = 0·002 grm. of NaCl—*i.e.*, equivalent to 2 grms. of NaCl per litre of silver solution, or 0·2 grm. of NaCl per 100 c.c. Now 2 grms. of NaCl are equivalent to $\frac{2 \times 170}{58{\cdot}5} = 5{\cdot}81$ grms. of $AgNO_3$; therefore weigh out 5·81 grms. of $AgNO_3$, dissolve in pure distilled water, and dilute to 1 litre.

From the preceding, it is seen that the silver solution is so made that 100 vols. thereof shall be equivalent to the amount of $l \times 0{\cdot}1$ in the weight, x, taken (supposing x to contain 100 per cent of l); so that n vols. being required, *p.c.* = $n \times 0{\cdot}1$.

3rd. Solutions of half strength are, also, often useful where the *p.c.* of l is usually very large, and but a small quantity of the body can be conveniently taken (to represent x), for various reasons. In this case *p.c.* = $n \times 0{\cdot}5$.

For a solution of the above strength, 100 vols. of such solution must be equivalent to the amount, $l \times 0{\cdot}5$, in the weight, x, taken (supposing x to contain 100 *p.c.* of l); so that if x = 1 grm., and n = 30 c.c. $30 \times 0{\cdot}5$, or $\frac{30}{2} = 15$ *p.c.* of l, are contained in the body experimented upon.

Of course, by varying the weight, x, in a particular manner, the same solution may be actually altered from decimal to half strength, or from half to full strength, &c.; thus, from decimal to half strength, take 1-5th x; from half strength to full strength, take ½ x; and from decimal to full strength, take 1-10th x.

The burette, which is used for titrating each solution, should be always used for that particular solution, as burettes which are graduated to hold equal volumes are very often found erroneous.

ECLIPSE OBSERVATIONS.

AMONG the various observations made at the last eclipse, none exceed in interest those of Professor C. A. Young, of Dartmouth College, Hanover, New Hampshire. We quote from the *Journal of the Franklin Institute* an abstract of this gentleman's report :—

The observer was a member of the party under the direction of Professor J. H. C. Coffin, of the Nautical Almanac Office, stationed at Burlington, Iowa.

The instrument employed was a spectroscope with 5 prisms of 45° each, having faces 2¼ by 3¼ inches; the collimator and telescope had apertures of 2¼ inches, with a focal length of 17. These were connected with a seeker" of 4 in. aperture and 30 in. focus, used eye-piece, and giving an image of the sun, 2½ i diameter, on the slit of the spectroscope. A gr screen at the slit determined positions of points sun's limb, and a wire micrometer measured the p of spectrum lines. The whole was mounted equa with slow motion screws.

Protuberances were noted before the eclipse at 100°, large and not very bright; at + 146°, an bright. The photographs show another at 155° escaped notice; also at −70° to 80° low, but pretty and at −130°, very large and bright, the princi Angles are reckoned on the sun's limb from th point, + towards the East, − towards the West.

The first contact was observed by watching the shortening and final extinction of the bright line, spectrum of the prominence, which happened to point of contact. The moon's approach was full thirty seconds before its actual appulse; the tion was perfectly easy, and the time deter certainly to be relied on within half a second, ar bly much less. The presence of a prominenc point of contact is not essential to the succes method, as there is everywhere on the sun's limb depth of chromosphere to answer the purpose.

It is proposed to apply the spectroscope to obs both of the external and internal contacts at transit of Venus.

During the totality, the following nine bright li observed in the spectrum, viz., c dazzling in b 1017·5 (near D, the numbers refer to Kirchhoff very bright, but not equal to c; 1250±20, ve position only estimated; 1350±20, like the p 1474 (a little below E) conspicuous, but not n half as bright as 1017·5; F, next to c in br 2602±2, a little fainter than 1474, position deter micrometrical reference to the next; 2796, a lit G, the well-known H.γ line in brightness betwe and 1474; and finally H, or Hδ, somewhat brig 1474. B was not seen, it is supposed on acc mistake in carrying that portion of the spectrut the field while there was no prominence on the

*The line 1474 was recognised as belongin spectrum of corona, in the first place, by its clear across the spectrum, while 1017 did not, a its remaining visible when the slit was moved a the protuberance, while the other lines (c and appeared. The impression of the observer is lines 1250 and 1350 behaved in the same manne recollection as to this point is not very certain.

These three lines, 1250, 1350, and 1474, co within the probable errors of observation with observed by Professor Winlock in the spectru Aurora Borealis. The two first are not accurate determined, in position, to allow much stress upon any apparent coincidences on their par last is perfectly well known, and its exact throughout with one of the fainter lines of t when combined with the general appearan Corona and other considerations, give a good d bability to the conjecture that our Aurora B the Solar Corona are identical phenomena.

* A careful examination of the photographs of the pr the eastern limb of the sun, upon which the slit of the was directed during the first half of totality, somewhat d confidence in the conclusion of the text, as to the nature lines. I think it absolutely certain that they do not t spectrum of the brilliant portion of the prominences; b graph shows, in addition, an extensive nebulosity sur nuclei with a pretty definite boundary of its own; this neb seen in No. 2 of the totality pictures taken at Burlingto possible that these lines may belong to this nebulosity, corona proper; for I cannot recall, with certainty, whethe retained its brilliance at any considerable distance minences. My impression is that it did, and that the f but do not wish to be too positive. The eclipse of Decem decide, of course.

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CHROMOSPHERE.

Dr. B. A. Gould, we find
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"This happy result is clearly attributable to the relative shortness of the time of exposure by which the highly photographic rays of the chromosphere have depicted themselves, without obliteration by the mass of coronal light which veiled them from the eye. Let us hope that at the next total eclipse some impressions may be taken with an exposure not exceeding a single second, as you have suggested. The inference seems warrantable that in this way, better than in any other, the internal structure of the protuberances may be exhibited, though other phenomena may fail to record themselves.

"You will observe that some of the brighter, petal-like flocculi of light have produced apparent indentations in the moon's limb at their base, like those at the basis of the protuberances. These indentations are evidently due to specular reflection from the moon's surface, as I stated to the American Association at Salem last month. Had any doubt existed in my mind previously it would have been removed by an inspection of the photographs.

"I shall send the substance of these remarks to Professor Coffin, as a sort of postscript to my report, which contains only the results of personal observation at the time."

SIMPLE APPARATUS
FOR
RAPID VAPOURISATION AT LIMITED HEAT,
UNDER REDUCED PRESSURE, WITHOUT USE OF A PUMP.

By A. B. PRESCOTT,
Assistant Professor of Chemistry, &c., University of Michigan, U.S.

THE pump is not always at hand; its use is forbidden for transmission of corrosive vapours; and, moreover, the removal of liquids, in form of vapour, against the weight of the air by muscular power is liable to "exhaust" the operator more effectively than it does the material. I desire to ask attention to some uses of ordinary distilling apparatus, for the production and maintenance of approximate vacuum over liquids during their vapourisation, in cases where the heat of 120° to 150° F. may be applied.

It is necessary that the distilling apparatus be made capable of air-tight closure, and that the air be removed from it to begin with. Then the degree of exhaustion in the apparatus is in direct ratio to the rapidity of condensation of the vapour produced. And the rapidity of condensation is only limited by the degree and extent of refrigeration employed, with a given extent of evaporating surface at a stated temperature. The air in the apparatus, to begin with, may be expelled through a suitable aperture by steam, which may be generated in the "receiver" of the apparatus or in an attachment thereto.

Take two round-bottomed glass flasks, the one having a capacity four to eight times greater than the other. Adjust the smaller upon a water-bath, the larger, at 10 or 15 inches distance from the other, over a sink or large basin, and connect the two with glass tubing and perforated caoutchouc stoppers, so that the connecting-tube shall incline slightly downward from its bend close to the stopper of the small flask. The stopper of the small flask is also to have a second perforation, in which is fitted a straight glass tube, 2 or 3 inches long, its lower end placed even with the lower end of the stopper. The upper end of this tube is very slightly drawn out for ½ of and inch, and snugly fitted with 1¼ inches of firm rubber tubing, the upper ¼ inch of which is closed with a piece of glass-rod of same diameter as the body of the tube.

Now put an ounce or two of water in the large flask, and the material to be evaporated in the small flask; close the stoppers perfectly, by turning the flasks under

them, and leave open the straight tube. Apply, by the water-bath, the limited degree of heat until it is imparted to the contents of the small flask; then move a lamp under the large flask until the water in it has boiled briskly and the steam therefrom has escaped continuously from the straight tube for some minutes. Now close tightly the straight tube with its caoutchouc cap, at the same time removing the lamp from the large flask. When the latter has cooled somewhat, wrap it smoothly with linen netting or gauze, and lead upon it a minute stream of cold water, controlling the same as required. The liquid in the small flask boils briskly (if aqueous, boiling at 120° to 150° F.), and the refrigeration is governed to prevent too violent ebullition, lest liquid be thrown into the connecting-tube: the degree of applied heat is governed to the same end.

An ordinary glass retort may be substituted for the small flask as an evaporating vessel, and its tubule may be fitted with a perforated stopper, admitting a thermometer. If there is not room in the stopper (of retort or flask) for both the thermometer and the steam-escape tube, the latter may be dispensed with by adjusting the stopper loose for escape of steam, and pressing it tight when the air is expelled. Flat-bottomed flasks favour equable boiling, but they are liable to collapse.

As a *condenser*, I have used, instead of the large flask, a copper vessel, for more ready application of heat without danger of breaking, and for more efficient refrigeration. This copper receiver (Fig.) is made of conical shape, with rounded bottom, a vertical diameter twice its horizontal diameter, and a neck bent to the angle of about 56° with the vertical axis of the vessel. The diameter of the neck is ¾ of an inch, to receive a retort beak, the joint being covered with a section of caoutchouc tubing. Or it may be fitted with a perforated stopper, to receive the connecting-tube of the flask when evaporation is conducted in the latter.

With linen netting to spread the water over the free surface of the condensers, the evaporation therefrom refrigerates with a comparatively small supply of water. Using a copper condenser of the above-described shape, a vertical diameter of 12 inches, and capacity of 6 pints, attached to an 8-ounce glass retort containing distillation promoters, I have vapourised 4 fluid ounces of water in sixteen minutes at the constant temperature of 128° F. By ordinary care in the expulsion of air and closure of the apparatus, exhaustion can be invariably secured, fixing the water boiling-point at or below 130° F.; that is, atmospheric pressure equal to at least 25 inches of mercury may be removed and sustained by availing ourselves of the displacing effect of steam, and the contraction of condensing vapour, in very simple apparatus.

Notwithstanding the illustrations of vacuum by condensation which abound upon the physical lecture-table, I do not know whether the devices suggested in this note have been tried or proposed for small chemical operations by anyone else. I have recommended them to students, and we have found them satisfactory for various analytical, experimental, and pharmaceutical operations. We have employed them chiefly in such evaporations as are performed for the residue only, or, at least, not for quantitative recovery of the distillate, in various evaporations of quantitative analysis, in the elimination of non-volatile alkaloids, in determining the organic matter in water, and in preparing fluid extracts. To evaporate at ordinary temperatures by hand-pump exhaustion is especially irksome in those cases when application of 125° to 150° F. is unobjectionable. And to connect a vessel under which heat may be applied with the air-pump involves quite as much labour as the arrangement of apparatus for exhaustion by condensation.

NOTICES OF BOOKS.

Exercises in Practical Chemistry. By A. Vernon Harcourt, M.A., F.R.S., and H. G. Madan, M.A. Series I., *Qualitative Exercises.* Oxford: Clarendon Press. 1869. 335 pages.

This joint work of Messrs. Harcourt and Madan is the last volume which has appeared in the very useful "Clarendon Press Series" of Messrs. Macmillan and Co.; and it forms the first half of a work which is to include quantitative analysis. The object of the work "is to furnish a systematic course of study to those who are beginning to learn chemistry practically;" and, with this in view, the authors have detailed, with much care and precision, the nature of, and the mode of manipulation with, all the more general apparatus, and have given in the Appendix suggestions for the construction of the simpler apparatus.

At the outset, we notice, under the head of "Memoranda," a series of ten aphorisms, embodying, in very terse language, rules for the attainment of the exactness and precision of action, and of the attitude of mind which must accompany chemical work. Such are:—

1. "Be orderly and neat in manipulation. Cleanliness stands at the head of the chemist's scale of virtues. All messes must be cleared away with the zeal of a sanitary inspector.
2. "Do not begin work in a hurry.
3. "Be economical of materials.
6. "Do not think merely of what will *do*, but what is *best*, of the means at your disposal.
10. "Finally, do not look upon chemistry as a mere amusement—as a means of getting up a few explosions, creating a few unsavoury smells, producing a few striking changes of colour. Chemistry is worthy of better treatment. It is no longer a 'black art,' but a refined science, and should be thoughtfully and reverently studied."

After the "memoranda," we have a list of the apparatus, and of the substances required for the work described. The illustrations of apparatus are, for the most part, drawn on the block direct from photographs taken by one of the authors. We do not notice the introduction of any new or modified form of apparatus; and that which is described is (as it should be) of the very simplest and cheapest description. Part I. is devoted to "Experiments on the Preparation and Properties of Substances," and this is commenced by an account of different operations, such as—"Fusion and Granulation;" "Glass-working;" "Solution, Evaporation, and Crystallisation;" "Precipitation and Filtration;" "Distillation;" Use of the Pneumatic Trough." Each of these is described with the utmost detail; for instance, more than two pages are devoted to the method of boring a cork, and more than three to the use of the pneumatic trough.

Section 2 treats of the "Preparation and Examination of Gases;" and each *exercise* is conveniently headed by a list of the apparatus and materials required for the preparation of the particular gas about to be described, even down to "cedar matches," and "a jug of water." We do not think that the list of experiments is at all sufficient; nor does there seem to be any effort to introduce new or modified effects. In the experiments in connection with oxygen, the burning of sodium in that gas is not mentioned; yet this is surely an experiment of the utmost importance, for it behoves the teacher to show the inappropriateness of the name oxygen, inasmuch as, by its combination with substances, are produced, not alone acid compounds, but also some which are neutral and alkaline. Again, the burning of naphthaline in oxygen is a very notable experiment; as, also, the burning of thallium, zinc, and aluminium. Hydrogen, nitrogen, and the protoxide and dioxide of nitrogen are next described; and an account of the collection of gases by displacement heralds "Carbon Dioxide," in the account of which we

are glad to notice the capital experiment of burning magnesium in a bottle of that gas, which is a far easier plan than the old arrangement of a bulb-tube and red-hot potassium. To separate the black flakes of carbon from the white flakes of magnesia, the bottle is to be rinsed out, and hydrochloric acid added to dissolve the magnesia. In order, follow—"Carbon Protoxide," "Ammonia," "Hydrogen Chloride," "Chlorine," "Ethylene," and "Sulphur Dioxide." Remembering to how large an extent the work before us will be used in schools, and the usual recklessness of boys, we think it behoves the authors, in the next edition, to add special precautions in regard to explosive substances. For instance, we do not think that nearly enough has been said about the danger of exploding ethylene with oxygen gas, from the careless management of which experiment a really serious accident might without difficulty arise.

Section 3 treats of the "Preparation of Reagents used in the Laboratory." The preparation of solutions of hydrogen sulphide, of chlorine, of chloride of tin, and of "Hydrogen and Silicon Fluoride," is here described. Then follows an extremely useful chapter on the "Preparation of Normal Solutions of Reagents," in which no less than thirty-seven solutions are described.

Section 4 treats of "Experiments with the Mouth Blowpipe;" and Part 1 is concluded by Section 5, wherein is detailed an "Examination of the Properties of the Principal Radicles and their Salts." Nearly one-third of the book is devoted to this subject; and explicit accounts are given of the properties and mode of examination of all the substances in most general use in the laboratory. The following may be taken as an example:—

"Place a bit of magnesium-ribbon, about 25 c.m. in length, in a test-tube, and pour on it some dilute hydrogen sulphate. Hydrogen gas will be evolved with effervescence, and the metal will gradually dissolve. When the action has ceased, pour off the liquid into a small porcelain dish, and evaporate it down until it begins to crystallise. Long prismatic crystals of magnesium sulphate (Epsom salts) will be deposited in abundance as the solution cools; these should be re-dissolved in about 20 c.c. of water, and separate portions of the solution tested as follows:—

(*a*) "To a portion, add a drop of two of solution of ammonium sulphide. No precipitate will be formed, since magnesium sulphide, unlike zinc sulphide, is soluble in water."

The other usual tests follow—sodium carbonate, ammonium carbonate, ammonia and ammonium chloride, and the blowpipe test with cobalt.

Part 2 treats of the "Qualitative Analysis of Single Salts," and is divided into six sections, of which the first explains the general nature of the analytical course; the second, the "Preliminary Examination of the Substance;" the third, the "Examination of the Solution of a Single Salt for a Metal;" the fourth, the "Examination of the Solution of a Single Salt for Non-metallic Radicle;" the fifth, the "Examination of an Insoluble Substance;" and the last, an "Example of the Analysis of a Single Salt." A general grouping of substances is given in the first section, together with a table showing the distribution of the principal metals into groups for the purposes of separation. The preliminary examination is discussed under thirty-one separate heads, and is very clear and precise. The whole subject of Part 2 is divided into seventy-four minor heads, and these are distinguished by bold-faced black figures placed near the margin. The extent to which printers' type can indicate a desired difference by its own difference of form is surely well shown in this work; for, in a single page, we observe no less than *nine* different kinds of type.

The work is concluded by six short appendices, whereof the first contains "Suggestions for the Construction of Chemical Apparatus;" and here we find such proposals as the conversion of a biscuit-tin into a pneumatic trough, of a door-handle into an Argand burner, and of a tobacco-pipe into a deflagrating spoon. Without doubt, it may be well sometimes for the student to exercise his ingenuity in this way; but, when we remember the extreme cheapness of all the more ordinary chemical apparatus, we do think a great deal of time is often wasted in the attempt to construct that which, after all, is but a clumsy and short-lived piece of apparatus. Appendix B discusses the recovery of gold, platinum, and silver from their residues. Appendix C contains a very useful table of the solubility of a number of salts, on the authority of Storer's "Dictionary of Solubilities." Appendix D contains "Tables of Weights and Measures." Appendix E treats of "Thermometric Scales." And, finally, Appendix F discusses the nature of chemical symbols, which are very sparingly used throughout the work. The index is short, but is, perhaps, sufficiently long for a book which, to a certain extent, constitutes its own index.

Regarding the book as a whole, it may be said to contain a large and varied amount of information; the matter is condensed as much as possible, although considerable minuteness of detail is frequently apparent. We confess that the arrangement often appears to us to be complex, and we do not grasp the design which the authors had in view in certain of their modes of arrangement. Indeed, every new work on Chemistry appears to us more complex than that which preceded it; Bloxam's "Laboratory Practice" is surely a less complex (but in all fairness, be it remembered, also a less comprehensive) work than that of Messrs. Harcourt and Madan; while, to our mind, the least complex work of all is "Bowman's "Practical Chemistry." It will be borne in mind that we speak here solely of arrangement of matter and simplicity of style. Perhaps we are too conservative in all this; perhaps we like too much *stare super antiquas vias*, but, truly, we think that much of the chemical literature of the period is characterised by unnecessary complexity and obscurity. At the same time it is undeniable that Chemistry itself is advancing in the same direction, and so long as this continues to be the case, we cannot expect to have a different literature. The importance of an extreme simplicity in the mode of teaching a new and difficult science to boys cannot be exaggerated. A boy with some glimmer of a taste for science will, if he meet with a rebuff at the outset, probably abandon the study altogether. The questions which boys ask after hearing a lecture indicate how they often unwittingly create difficulties, and in the abstruse branches of analysis these difficulties must more frequently arise. Let it be remembered, however, that Messrs. Harcourt and Madan have had much experience in science teaching, and we may feel very sure that they have embodied the sum and substance of that experience in the work before us. They are both well qualified to write on the subject, and they have done justice to it. Their work appears very opportunely, for now, more than ever, is the establishment of school laboratories and science classes receiving the attention of all who are interested in the educational progress of this country, and we are well assured that the work we have been considering will be much used both in the higher classes of our schools and in our universities.

The City of London Gas Act.—We have received from Dr. Letheby his report on the results of the daily testings of the gas supplied to the City during the quarter which ended on the 30th day of September last, from which we find that the maximum illuminating power of the Cannel gas supplied by the City of London Gas Light and Coke Company has been equal to 27·50 standard sperm candles, the minimum to 19·50 candles, and the average to 24·58. The gas supplied by the three companies has been free from sulphuretted hydrogen, but the proportions of sulphur have fluctuated to a large extent. Ammonia has also been found in the gas supplied by the Chartered Company. The use of Sugg's New London Argand Burner of 24 holes shows an increase of illuminating power of sixteen per cent.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, October 25, 1869.

The following original papers and memoirs bearing upon chemistry and physical science are contained in this number:—

Remarks on the Communications made by MM. Vergnette, Lamotte, and Thenard.—M. Pasteur.—The author of this lengthy and criticising review condemns, in terms fortunately not frequently heard in the Mazarin Palace, the processes of the preservation of wine by heating it. The paper is too lengthy to admit of abstraction, and is, moreover, only of interest to wine-growing countries.

Fundamental Equations of the Mechanical Theory of Heat.—M. Reech.—A purely mathematical paper.

Illumination of Transparent Substances by means of Polarised Light.—M. Lallemand. In order to see the illumination of any fluid, water, for instance, it is poured into a glass tube, which is closed at both ends by means of pieces of plate glass; the tube is then placed in a dark chamber in a horizontal position, and a ray of polarised light is made to shine upon the tube, which, when looked at sideways, will exhibit a vivid glimmering; but, seen in any other direction, the tube remains dark. Hence, it follows that the propagation of the light takes place in the direction of the plane of polarisation; and it also follows that the vibrations of the waves of the ether take place in the perpendicular direction. When, instead of water, any other fluid is taken which is endowed with rotatory power—a solution of sugar, for instance—a very beautiful chromatic effect is displayed; the colours of the spectrum will be seen distributed in an elliptical shape. Cylinders of solid glass, submitted to the same experiment, exhibit somewhat similar phenomena, but less conspicuously than fluids.

Calorific Rays Emitted by the Moon.—M. Marié-Davy.—The author retracts his former negative statements on this subject, and now proves that, by another, and differently-conducted set of experiments, he found that the moon emits calorific rays in abundance. The secretary read, also, a memoir on this subject, by M. Volpicelli, who, quoting the observations of more ancient and modern *savants*, comes to the conclusion, also, by his own observations, that the moon emits heat.

Bronzing of Copper.—M. Zalewski.—When objects made of copper are immersed in molten sulphur wherein lamp-black is kept suspended, the objects so treated obtain the appearance of bronze, and can be polished without losing that aspect.

Influence which Divers Luminous Rays Exert upon the Decomposition of Carbonic Acid, and the Evaporation of Water from the Leaves of Plants.—M. Dehérain.—The author, having extended his experiments on this subject, now states that all the luminous rays are not equally active in the decomposition of carbonic acid; that, even when the intensity is the same, the yellow and red rays act more favourably than the blue and violet rays; that the relation between decomposition and evaporation remains unaltered.

Preparation of Oxygen.—M. Delaurier.—The author states that, when manganate of lime is heated, oxygen is abundantly given off, and that by means of this salt it may be made very economically.

Metrical Weights and Measures.—M. Jacobi writes to the effect that the Royal Prussian Academy of Sciences is favourably disposed towards the proposal to establish an international committee for weights and measures.

Testamentary Disposition by M. Lacaze.—The perpetual secretary, M. Dumas, announces that the late M. Lacaze has bequeathed to the Academy a sum of 10,000 francs (£400), the interest of which is to be applied, bi-annually to the distribution of prizes for chemistry, natural philosophy, and physiology.

The Journal of the Franklin Institute, September, 1869.

This number contains the following original papers and items:—

Gas Blasting.—While an excavation for a gas-holder tank was being made at Oswego, an old well had been pumped out and then filled up, after leaving an aperture beneath. Into this space a limited quantity of gas was introduced from the gas pipe, sufficient to form an explosive compound with the air in the covered well; this mixture being exploded by suitable means, caused a general upheaving of the surrounding earth, loosening the soil, and making digging easier.

Analysis of Hathorn Spring Water.—Dr. Chandler.—Grains to the gallon—Chloride of Sodium, 509·368; chloride of potassium, 9·597; bromide of sodium, 1·534; iodide of sodium, 0·198; fluoride of calcium, a trace; bicarbonate of lithia, 11·447; bicarbonate of soda, 4·288; bicarbonate of magnesia, 176·463; bicarbonate of lime, 170·646; bicarbonate of strontia, a trace; bicarbonate of lime, 1·737; bicarbonate of iron, 1·128; phosphate of soda, 0·006; biborate of soda, a trace; alumina, 0·131; silica, 1·200; organic matter, a trace; total solid constituents, 888·403 grains; carbonic acid gas in one gallon, 375·747 cubic inches; specific gravity, 1·009.

Various Processes for Preserving Timber.—Dr. Ott.—From this paper, which is to be continued, we learn that the first attempts in this direction were made by the German chemist Glauber, and consisted in first charring the surface of the timber, then coating it with Stockholm tar, and immersing it in crude acetic or more properly pyroligneous acid. The author then reviews at length the various methods applied for the preservation of timber, treating of injection with brine, or salting timber, which is not of much use unless, indeed, the salt could be made to penetrate through the very heart. Speaking of Mr. Beer's process, that is to say the treatment of wood in a boiling solution of borax in water, the author observes that beside the ready solubility of borax in water (one part in twelve of cold water), borax, like all alkaline salts, has the property of dissolving, or at least attacking, the so-called incrustating matter of the wood, upon which its strength, solidity, and toughness greatly depend; moreover, borax also dissolves the resin which is therefore eliminated from the wood, and in regard to its (borax) claimed superiority in withdrawing the putrefiable substances, it may be stated that not less than 14 per cent of the original amount of albumen have been retained in saw-dust, after boiling it several times, and each time for hours with a saturated solution of borax.

Cosmos, October 23, 1869.

Extracts from Vegetables.—M. Berjot.—This gentleman has applied to the vegetables in ordinary use for culinary and domestic purposes the process long since very successfully carried out for vegetables to be used in pharmacy, viz., of expressing by strong hydraulic pressure the juices of such vegetables, and concentrating the same by evaporation *in vacuo*, and preparing extracts thereof suitable for making soups and sauces, 1 gramme of these extracts being sufficient to convert 1 litre of bouillon into a good soup.

Porte-plume-encrier Vélocigraphe.—Dr. Poznanski.—Under this title is described at great length, accompanied by a woodcut, an instrument which, if what is stated about it is correct, will, in a very short time, be greatly in demand by all who have much writing to do. The instrument is a combination of pen-holder, pen, and ink reservoir, and the ink flows into the pen by means of a self-acting valve and piston, as long as the writer requires it; we cannot give more details without re-producing the cut.

Estimation of Urea.—Dr. Byasson.—Take 50 c.c. of the urine to be tested from the urine in a flask, and next add 25 c.c. of baryta water, and shake the mixture, filter off the precipitate, the filtrate from which should be alkaline; take 10 or 20 c.c. of this filtrate, and pour it in a vessel suitable for precipitation, and place the vessel on a sheet of white paper; then add from a graduated burette a mercurial solution (made by dissolving 36 grammes of red oxide of mercury in 50 grammes of nitric acid diluted with as much water; this dissolution is aided by heat and carried on until, by evaporation, red fumes are beginning to be given off, when the saline mass is dissolved in 1 litre of distilled water), keeping the fluid well stirred. From time to time small quantities of a solution of caustic potassa of 25 grammes to the litre are added; by this proceeding a yellow precipitate is formed. This first assay is only approximative, and should be followed by at least two other similar operations. Every c.c. of the mercurial liquid applied represents 0·005 gramme of urea; the mercurial solution is controlled by means of a urea solution made by dissolving 20 grammes of crystallised urea in 1 litre of distilled water.

Zeitschrift für Chemie von Beilstein, No. 19, 1869.

This number contains the following original papers:—

New Method for the Synthetical Preparation of Salicylic Acid and its Homologues.—M. Vogt.—The author says—Some few months ago, M. Oppenheim and I proved that chloride of phenyl is not readily acted upon by fusing caustic potassa, unless that chloride is converted into the corresponding sulpho-acid. While the writer was engaged in experiments with chlorinated toluol and xylol, expecting to obtain orcine and β orcine, the result was the formation of salicylic and cresotinic acid. Chlorinated toluol was mixed with fuming sulphuric acid, and afterwards submitted to heat; as soon as the chlorinated compound was dissolved, the mixture was diluted with water, and baryta solution was added, until a precipitate ceased to appear. The liquid was next filtered, and neutralised with a solution of carbonate of potassa; in this manner a salt, $C_7H_6ClSO_3K$, was obtained in pearly plates. This compound was fused with caustic potassa, and, after a lengthy purifying treatment, first with water, next hydrochloric acid in excess, then ether, and again saturation with carbonate of potassa, and decomposition, again, of the saline mass by excess of an acid, salicylic acid was obtained, in small quantity, but sufficient to test its most prominent features. Bromated toluol,

treated in the same manner, yields the same result. Chlorinated xylol, submitted to the same treatment, yields cresotinic acid, a solid substance which crystallises in elongated prisms, fuses at 148°, difficultly soluble in water, and yields, with chloride of iron, a violet tinge.

Action of Deutoxide of Nitrogen upon Terpen.—M. Bunge.—The author says—Some thirty years ago, M. Cahours published a paper wherein it was stated that deutoxide of nitrogen combines with the terpen of essential oil of feuchel, yielding a substance, $C_{15}H_{24}(NO)_6$, which, consequently, is a nitroso hydrocarbon. These researches of the last-named author have been repeated by the author of this paper, with the following results:—(1) Pure deutoxide of nitrogen does not combine with the terpen of essential oil of feuchel, and is hardly even absorbed by it; (2) when the deutoxide of nitrogen is brought into contact with the aforesaid terpen, air being at the same time admitted, the compound described by Cahours is formed; (3) pure hyponitric acid, prepared from nitrate of lead free from chlorine, is plentifully absorbed by the terpen alluded to, but the result is not the formation of a crystalline substance; (4) when the terpen is mixed with an aqueous solution of nitrite of potassa, to which some acetic acid is added, the terpen is thereby converted into a crystalline mass, which, although identical with that described by M. Cahours, differs from it in composition, its formula being $C_{10}H_{14}(N_2O_3)$. Ordinary oil of turpentine (purified, of course), and the terpen from Copaiva balsam, do not yield, when treated as described, crystalline compounds. When the nitrate of lead, employed for the evolution of hyponitric acid, contains chlorine, or if, purposely, chloride of lead is added to the nitrate, and the gas thus obtained be passed through the terpen of essential of feuchel, this fluid soon becomes turbid, and the result is the formation of a substance insoluble in water and hardly soluble in either absolute alcohol or ether; this compound is expressed by the formula $C_{10}H_{14}NO_3Cl$. The terpen of copaiva balsam yields an analogous compound.

Formation of Green Sulphide of Manganese by the Wet Way.—M. Muck.—When the salmon-coloured sulphide of manganese is submitted to heat while yet in moist state, it becomes green. The author distinctly states that the green sulphide alluded to is not identical with that obtained by the dry way. After quoting several observations of the same phenomenon recorded by other scientific men, the author says—The salmon-coloured sulphide of manganese, when seen under the microscope with a magnifying power of from 200 to 300 diameters, is observed to be a completely amorphous substance; the green sulphide, however, exhibits, under the same conditions, greenish coloured transparent quadratic tables. The preparations of manganese applied for the purposes of experiments, are perfectly pure, and quite free from any other metals precipitable by hydrosulphuret of ammonium. The results of a series of researches on this subject are, that, when an excess of hydrosulphuret of ammonium is applied as precipitant:—1. Very dilute and cold solutions of the chloride and sulphate of manganese yield a salmon-coloured MnS, which, even when kept for several weeks, does not exhibit the least tendency to become green coloured. 2. The same solutions, when precipitated while hot, yield flocculent precipitates, which are bright green-coloured; the solution of the sulphate yields a precipitate akin in colour to the hydrated oxide of chromium. 3. When the same solutions are quite concentrated, the precipitates formed are, at first, salmon-coloured; but, after a short time, and even without the application of heat, the precipitates, while shrinking enormously, and becoming pulverulent, get green-coloured. When a large proportion of a solution of chloride of ammonium was added to the solutions of the salts of manganese just alluded to, previous to adding the precipitant, a nearly blackish green, very dense MnS was thrown down. The following salts of manganese, in solid state, behave towards hydrosulphuret of ammonium in the manner thereby respectively expressed:—The chloride is rapidly converted into a green sulphide, even at the ordinary temperature of the air; the sulphate is more slowly acted upon, but the result is the same; the nitrate, solid as well as solution, is only partly converted into a green sulphide; the phosphate and oxalate yield, rapidly, a green sulphide; the carbonate never yields a green sulphide, but always the salmon-coloured. A concentrated solution of the chloride of manganese yields, on being precipitated by the hydrosulphuret of ammonium only, then, a green sulphide of manganese when the precipitant is in excess and all the metal thrown down; the green sulphide yielded, on careful analysis, by means of drying in a current of dry sulphuretted hydrogen gas, 7·43 per cent of water. When, instead of hydrosulphuret of ammonium, the various soluble sulphides of potassium or sodium are applied as precipitants, the author never obtained a green sulphide of manganese under any conditions.

Conditions under which the Sulpho-Carbanilide and some Analogous Substances are Decomposed.—MM. Merz and Weith.—The subject treated of in this lengthy essay may be summarised in the following manner:—The authors proved that nascent hydrogen has the effect of desulphurising sulphocarbanilide; but, instead of obtaining, as they expected, methylendianiline, other products appeared. This phenomenon they attributed to the presence of acid, and, therefore, they repeated experiments formerly made, and applied perfectly neutral solutions; but this precaution, notwithstanding the sulpho-carbanilide, was decomposed as before. The paper contains, further, a lengthy description of the origin and products of decomposition of a number of complex organic substances, as, for instance, triphenyl-guanidine, sulpho-carbanilamide, tricarbo-hexanilide, and others.

Action of Permanganate of Potassa upon Quinine.—Dr. Kerner.—One part of pure quinine is dissolved in excess of pure nitric or hydrochloric acid; the solution is heated to about 50° or 60°, and there is added to it a concentrated solution of two parts of permanganate of potassa in water at the same temperature, and the liquid well stirred and heated some 15° or 20° higher. The fluid is separated by filtration, from the precipitate of peroxide of manganese, and next evaporated to about one-eighth of the original bulk. The liquid, which should exhibit an alkaline reaction, is next acidified, upon which the new substance, dihydroxyl of quinine, is precipitated; this material will require to be purified from colouring matter by means of a very dilute solution of soda. The purified substance, after having been re-crystallised from its aqueous solution, exhibits a crystalline material, difficultly soluble in cold water and alcohol, and more readily so in these fluids when hot. Its composition is represented by $C_{20}H_{26}N_2O_4$; its formation from quinine may be represented by—

$$C_{20}H_{24}N_2O_2 + H_2O + O = C_{20}H_{26}N_2O_4.$$

On Oxytoliden.—MM. Limpricht and Schwanert.—When an ethereal solution of toluylen is treated with bromine, there is formed, besides bromated compounds, a substance, $C_{14}H_{10}O_2$, which the authors call oxytoliden, in pure state exhibiting a solid crystalline substance, fusing at 172°, subliming at a higher temperature, without decomposition, soluble in ether and alcohol, not acted upon by an alcoholic solution of potassa, neither by reducing agents. The authors obtained, by means of the action of chlorides of phosphorus upon this oxytoliden, chloroxytoliden, $C_{14}H_9ClO_2$, a solid substance, fusing at 57°, and soluble in alcohol; trichloroxytoliden, $C_{14}H_7Cl_2O_2$, also a solid substance, fusing at 87°, and readily soluble in warm alcohol; pentachloroxytoliden, $C_{14}H_3Cl_5O_2$, a solid matter, fusing at about 190°, and difficultly soluble in hot alcohol. The structure of oxytoliden is represented by—

$$C_6H_4{-}O{-}CH$$
$$C_6H_4{-}O{-}CH$$

On Thionessal, Tolallylsulphide, Lepiden, and Oxylepiden.—Dr. Dorn.—Thionessal, $C_{20}H_{20}S$, is not readily desulphurised, even by being heated to a feeble red heat along with either iron or copper filings. The heating of thionessal with chloride of phosphorus also fails to effect desulphuration; but there is formed a bichloride of thionessal, $C_{20}H_{18}Cl_2S$, a solid substance, fusing at 219°. Tolallylsulphide resists the action of red-hot copper; but, on being treated with chlorate of potassa and hydrochloric acid, it is readily converted into oxylepiden, and therefore the formula of tolallylsulphide ought to be $C_{20}H_{20}S$. Oxylepiden, $C_{20}H_{20}O_2$, when acted upon by reducing agents, is converted into lepiden, $C_{20}H_{20}O$, which does not, however, give up any more of its oxygen to any reducing agents; and when it is treated with chloride of phosphorus, yields a series of products of substitution, containing chlorine—viz., bichloroxylepiden, $C_{20}H_{18}Cl_2O_2$; bichlorlepiden, $C_{20}H_{18}Cl_2O$; pentachlorlepiden, $C_{20}H_{12}Cl_5O$; hexachlorlepiden, $C_{20}H_{14}Cl_6O$; and octochlorlepiden, $C_{20}H_{12}Cl_8O$. All of these are solid substances.

The Pyromucic Acid Group.—M. Limpricht.—The combinations of this group can, according to this author, be deduced from a hydrocarbon—

$$HC{=}CH$$
$$HC{=}CH$$

In order to prove this statement, a series of experiments have been made, which are recorded in this paper. Pyromucic acid in aqueous solution is decomposed by bromine, with evolution of carbonic acid, according to the following formula:—

$$C_5H_4O_3 + H_2O + Br_2 = C_4H_4O_2 + CO_2 + 2HBr.$$

There are simultaneously formed a bromo substitute, an oily substance, and, under conditions which are not precisely defined, a compound, $C_5H_3BrO_2$, a solid, insoluble in water, alcohol, and ether, and fusing at 84°. Among the products of the complete decomposition of an aqueous solution of pyromucic acid, fumaric acid, $C_4H_4O_4$, occurs; and this acid, treated with sodium amalgam at 180°, yields succinic acid.

Arsenic in the Soda of Commerce.—Dr. Fresenius calls attention to a fact, accidentally discovered by him, that the carbonate of soda (neutral), as met with in crystallised state, and as manufactured at the alkali works, now often contains a very perceptible quantity of arseniate, or arsenite of soda, undoubtedly due to the use of sulphuric acid for converting the common salt into sulphate of soda, which acid contains arsenic, derived from the pyrites of which few are quite free from arsenic, and some of which contain that substance in considerable quantity. The tests applied for the detection of this arsenic were not the most delicate in use for this purpose; and the quantity found, though small, is sufficient to affect the purity of preparations for medicinal and chemical use.

Les Mondes, October 28, 1869.

From this number we abstract the following original communications and papers:—

Electrical Explorator.—M. Trouvé.—Although this subject does not exactly bear upon chemical science, we may call attention here to what is stated in the original. The explorator alluded to is a small instrument destined to detect, by means of electricity (galvanic current), any metallic or other objects, but especially rifle-balls and pieces of shot and shell, which may have penetrated the body or limbs of men and animals. At an Exhibition, recently held at the Hague, of objects relating to army surgery, and the necessary means of taking care of the wounded in battles, Dr. Winkhuijsen, physician to His Majesty the King of the Netherlands, ingeniously introduced, in limbs made of plaster of Paris, different projectiles of iron and lead, and with thus enabled to exhibit the action of this very useful instrument, by the aid of which, even though no open wounds exist, the presence of such projectiles may be readily detected with certainty, and the extraction

proceeded with. Not only metallic, but also stone and wooden objects, which might have penetrated, can be detected.

On Combustion.—M. A. Boilot.—The author's chief conclusion on this subject is, that the distinction between supporters of combustion and combustibles is a pure fiction; there are neither combustibles, nor supporters of combustion, nor, also, any inert substances. In all reactions, each substance brings with it a portion of caloric, and absorbs a certain quantity thereof. Incandescence and heat are, in many cases, principally, if not solely, due to oxygen, but equally so to other bodies under other conditions. Oxygen is not only a supporter of combustion, but it is as much a combustible as the substances which burn in it.

Galvanic Tinning.—M. Maistrasse-Dupré.—The author, it appears, has been commissioned by the French government to apply, by galvanic means, tin upon divers objects which had been made of so-called galvanised iron—that is, iron covered with zinc. To this purpose he applied galvanic elements made of copper and zinc plates, the length of which is 1·20 metres, the width 0·70 metre, placed in a leaden trough, and separated and isolated by means of wooden partitions. The copper sheet was immersed in a mixture of equal parts of acetate of lead and common salt, and the zinc element was placed in weak sulphuric acid, sp. gr. 1·060. This battery remains in constant action and working order for eight days, at an outlay of only 2 francs. When the objects which are galvanically tinned are afterwards heated to the melting-point of tin, the goodness and durability of hot-tinned materials is thus obtained. Copper thus tinned (galvanically), and afterwards heated, is superficially converted into bell-metal, while the method of tinning galvanically has the great advantage over the old method, that it can be applied to objects to which the method of tinning in ordinary use is not applicable.

Automatic Steam-Boiler Feeding Apparatus with Constant Level.—M. Macabies.—In a few words, we call attention to an excellent piece of useful apparatus, not a toy or complicated mechanism requiring highly-skilled labour for superintendence. It is placed on the boiler, and, as soon as steam is up, begins its work, and acts uninterruptedly, pumping, or rather sucking, either cold or boiling water, even from great depths, and forcing it regularly into the boiler. There are no parts in the apparatus liable to get out of order; and, though its construction and mode of action could not be well understood without woodcuts, its main principle and action is that of the well-known Monte-Jus.

New Source of Quicksilver.—A layer of quicksilver ore has been recently discovered in the district of Sarawak, Borneo, which ore promises to be one of the richest in the world. A trial of a large quantity of this ore has been made, and proved to yield from 70 to 80 per cent of metal; this ore is, therefore, very nearly pure sulphide of mercury, and is of very rare occurrence, since the average of mercury ores yet known do not contain more than from 2 to 20 per cent of metal. Borneo is rich in minerals of all sorts, and the ores found there are of exceedingly good quality.

Researches on Tobacco.—M. Schlœsing.—Most of our readers will be aware that the sale of tobacco is a monopoly of the French Government; but it is not so generally known that, at the very extensive central manufactory at Paris, there is established a very well-arranged chemical laboratory, where researches are being continually conducted with tobacco, in its various stages of preparation, as well as in its green, or, rather, raw-dried state. There are very few substances produced, either by the vital functions of plants or animals, which contain so large a variety of different chemical compounds as tobacco does. The inorganic substances it contains are:—Potassa, lime, magnesia, oxides of iron and manganese, ammonia, nitric, sulphuric, hydrochloric, and phosphoric acids, and silica. The organic substances are:—Nicotine, $C_{10}H_7N$; malic, citric, acetic, oxalic, pectinic, and ulmic acids; nicotianine; a green and yellow resin; wax and fat; albumenoid substances; and cellulose. Nicotianine, also known as tobacco camphor, is a fatty substance, exhibiting the pleasant aromatic odour of tobacco-smoke, and having an aromatic bitter taste. Nicotianine is probably identical with coumarine. Nicotine is an organic base; it is, in the pure state, a colourless, oily liquid, of very acrid taste; soluble in water, alcohol, ether, and oil; and a most dangerous poison. According to the author, the quantity of this substance contained in 100 parts, by weight, of dry unmanufactured tobacco-leaves, ripped from the stems, varies considerably, even for tobacco cultivated in France, from 7·96 to 3·24 per cent; for American tobacco, the quantity varies from 6·87 to 2·29 per cent; while the so-called Habana (properly Cuba) tobacco contains only 2·0 per cent of this alkaloid. Snuff, which contains on an average 33 per cent of water, contains 1·36 per cent of nicotine. The quantity of ash contained in tobacco in dry state varies from 19 to 27 per cent. 100 parts of the ash contain:—Potassa, 29·96; soda, 2·76; lime, 39·53; magnesia, 9·61; chloride of sodium, 9·65; sulphuric acid, 2·78; silica, 4·51; phosphate of peroxide of iron, 4·20. The more or less easy combustibility of tobacco does not depend upon the quantity of nitre it contains, since experiments made by the author have proved that the Kentucky tobacco, which contains a large quantity of saltpetre, burns badly, while Java, Maryland, and Hungarian tobacco, which contain hardly any saltpetre at all, burn very well. The author found that tobacco which burns badly, or not at all (at least, not so as to be suitable for the use of smokers), burns very well after having been steeped for some time in an aqueous solution of an organic potassa salt (oxalate, malate, citrate, or tartrate answer the purpose), and next dried. A well-burning tobacco becomes badly-burning, or even non-combustible, by being steeped in aqueous solutions of sulphate of lime, chloride of calcium, magnesia, or ammonia. The rationale thereof lies in the fact that the organic salts of potassa just alluded to yield, on combustion, a very bulky, porous, and light coal, which burns off readily on access of air. This paper contains some very important facts relating to the preparation of tobacco and snuff, obtained on a very large scale, working with some hundreds of thousands of tons annually.

Polytechnisches Journal von Dingler, second number for September, 1869.

This number contains the following original papers relating to chemistry:—

Construction of Sulphate Furnaces (Sulfatöfen).—M. Lunge.—This paper is an excellent contribution to the technology of the manufacture of soda by M. Leblanc's process; but the paper is not well suited for abstraction, since there are added to it several engravings absolutely required for the proper understanding of the subject.

Manufacture of Sulphate of Alumina.—M. Pemberton.—Hydrate of alumina is mixed with sulphuric acid and water in the requisite proportions for the formation of neutral sulphate of alumina, $Al_2O_3.3SO_3+18HO$; the best proportions are 150 kilos. of moist hydrated alumina, containing 38 per cent of that hydrate, and 200 kilos. of sulphuric acid at 58° Beaumé (sp. gr., 1·678). These quantities yield from 325 to 340 kilos. of neutral sulphate of alumina, which crystallises readily. It should be borne in mind that no larger quantities than those just named should be operated with at one and the same time, because the chemical action which sets in is very violent, and if the heat thereby evolved becomes too great, the operation is spoiled.

Preparation of Indium in Pure State.—MM. Rüszler and Wolf.—The authors make use of the Freiberg zinc for the purpose of obtaining indium. The zinc is dissolved in hydrochloric acid, and next boiled with excess of metallic zinc, whereby a spongy metallic precipitate is obtained of the following composition:—Lead, 1·36; tin, 0·02; cadmium, 0·13; copper, 0·004; indium, 0·015; together, 1·529 per cent of the metallic zinc employed. This mass is first treated with sulphuric acid to remove the lead. The whitish-coloured mass is next treated with boiling water; this solution is again treated with zinc, whereby a spongy metallic mass is obtained, which is acted upon by strong nitric acid, the excess of which is evaporated, and the oxides of tin and any remaining sulphate of lead are eliminated. The residue is taken up with water, to which ammonia is added, whereby the oxide of indium is precipitated; and, after drying, this oxide is reduced to the metallic state by means of cyanide of potassium.

Artificial Preparation of Anthracen.—Dr. Greiff.—The author prefers the preparation of anthracen from asphalte or pitch, instead of coal-tar, since the purification of the product is more readily effected when it is obtained from solid substances, by sublimation, in a manner somewhat similar to the manufacture of carbonate of ammonia. Too much and too long heating should be avoided. The quantities of anthracen yielded by tar, as well as by asphalte, vary greatly, and the cause thereof is not at present well ascertained.

Keeping Water in Tanks made of Zinc.—M. Ziurek.—The author calls attention to the fact that water kept in zinc vessels (reservoirs), or, also, collected from roofs covered with that metal, is invariably contaminated with that metal, and that the use of such water, either for domestic or industrial purposes, is highly injurious to health. The author recommends that, where zinc vessels are used for the purpose indicated, they should be painted over with asphalte varnish or any iron pigment.

Journal de Pharmacie et de Chimie, October, 1869.

This number contains the following original papers:—

Chlorides of Acetylen and Synthesis of the Chloride of Julin.—MM. Berthelot and Jungfleisch.—The authors have made perchloride of antimony act upon acetylen, which is very readily absorbed by this chloride with evolution of great heat, in consequence it becomes necessary to moderate the action, so as just to keep whereof the mixture in fluid state. On cooling, magnificent large crystalline lamellæ are deposited, which are a compound of acetylen and perchloride of antimony, $C_4H_2SbCl_5$. This compound is very unstable; it is immediately decomposed by water, and on the application of heat it is converted into perchloride of acetylen and protochloride of antimony, $C_4H_2.SbCl_5=C_4H_2Cl_2+SbCl_3$. Protochloride of acetylen, $C_4H_2Cl_2$, is a clear, colourless, very mobile liquid, exhibiting, in a high degree, the smell of chloroform; its taste is somewhat sweet, and its vapour causes headache; it boils at 55°; water, as well as moist air, decomposes it slowly; and if heated, along with water up to 180°, it is decomposed into hydrochloric acid and some volatile products. Heated to 360° in a sealed tube, it is entirely decomposed into a black carbonaceous mass and hydrochloric acid, without giving rise to any secondary products. Perchloride of acetylen, $C_4H_2Cl_4$, is a colourless fluid, exhibiting the smell and taste of chloroform; it boils at 147°; heated to 180°, along with water, it is slowly decomposed; brought into contact with chlorine gas, it is converted into sesquichloride of carbon. By cautiously treating this compound with an alcoholic solution of caustic potassa, hydrochloric acid is withdrawn, and protochloride of acetylen formed. Heated to 300°, for at least twenty-four hours, in a sealed tube, the chloride of julin is formed, which is obtained even better by allowing the heat to act up to 360° for 100 hours consecutively. The chloride of julin is identical with perchloride of benzine.

Boiling and Melting Points.—M. Fleury.—The determination of temperatures requires a correction for that portion of the column of mercury of the thermometer which is not itself immersed in the hot

medium. This correction is very liable to error, which may amount to even 10° or 15°. The author proposes the use of a metastatic thermometer.

Researches on the Bleaching of Tissues.—M. Kolb.—This paper contains the first instalment of a lengthy series of researches on this subject, but it is not well suited for abstraction.

Milk at Marseilles, and Milk in General.—M. Commaille.

Reagent for Copper and Iron.—M. Bellamy.—The alcoholic tincture of Campeachy wood, sometimes applied for the detection of bicarbonate of lime in potable waters, is, according to the author, a most valuable test for the detection of very minute quantities of iron or copper present in water. Both metals turn the colour of this tincture, when added to water containing minute quantities of the same, to a peculiar blue colour. According to the researches made on this subject, 1 grm. of iron, present in 20 cubic metres of water (rather more than 20 tons in weight), has the effect of being perfectly detectable by this tincture—that is, 1 part of metal in 20,000,000 parts of water; but after the water has been boiled, no reaction is observed. The metals are chiefly found in natural potable waters as carbonates.

Analysis of the Spring Water from Santa Catalina and Guadalupe (Canary Islands).—M. Méhu.—This spring, although only situated at 85 metres from the sea-board, does not exhibit any sign of being connected with the sea. The water of the spring is very clear, its taste saline, and the yield abundant; it reddens litmus paper; temperature, 26·66°. The dry residue from 1 kilo. of water, evaporated, and the residue dried at 180°, weighs 8·47 grms. The composition of the solid residue, expressed in grm. weight, is:—Chloride of sodium, 6·0921; chloride of potassium, 0·1080; chloride of calcium, 0·2833; bicarbonate of lime, 0·1482; bicarbonate of magnesia, 1·1654; sulphate of magnesia, 0·8766; silica, 0·1084; free carbonic acid, 1·0112. The weight of the anhydrous salts contained in 1 litre of this water amounts to 8·7828 grms. Guadalupe spring (*Gran Canaria*).—This spring is situated at a height of 210 metres above sea level, at a distance of 4 kilometres from the sea shore, and at 10 kilometres from the Santa Catalina spring. The temperature of the water of this spring is 29°, and it yields 514 litres of water per hour. The composition of the residue, after evaporation of 1 kilo. of the liquid, and drying at 180°, expressed in grm. weight, is:—Chloride of sodium, 0·11606; bicarbonate of soda, 0·79673; bicarbonate of potassa, 0·01978; bicarbonate of lime, 0·42351; bicarbonate of magnesia, 0·26473; sulphate of magnesia, 0·10700; silica, 0·11850; free carbonic acid, 1·05790. Weight of anhydrous salts to the kilo. of water, 1·845 grms.

Preparation of Nitrogen.—M. Levy.—When bichromate of ammonia is heated in a retort, that salt is converted into green sesquioxide of chromium, vapour of water, and pure nitrogen.

Revue Hebdomadaire de Chimie, October 28, 1869.

This number contains the following original papers and communications:—

Proper Mode of Sampling and Preserving the Samples of Raw Sugar for Quantitative Analysis.—M. Weinzierl.—The author calls attention to the discrepancies of the results of the analysis of raw sugars taken from the same large parcel, and submitted to investigation by different analytical chemists, in order to prove, by incontrovertible evidence, that, even when the samples are carefully taken (it is generally done by experienced brokers, who, being provided with proper tools, have thereby the means of taking from every box, cask, bag, kranjang, or basket, as the case may be, a fair sample representing the entire quantity contained in such parcel). The mode of keeping and preserving these samples may seriously interfere with the results of the analysis. For this purpose, the author has compared samples of raw sugar, kept in pasteboard boxes for 24, 48, 72, and 96 hours respectively—(1) kept in similar boxes inside lined with tin-foil; (2) kept in pasteboard boxes which were four times varnished with shellac varnish; (3) pasteboard boxes painted over with the paint ordinarily used for painting the sheet-iron sugar-loaf forms; (4) samples kept in tinned-iron boxes; and, lastly, samples kept in glass-stoppered bottles. The result of analysis of samples thus kept for 96 hours was as follows (the original sample, immediately on being taken, gave, in 100 parts—sugar, 91·70; water, 3·54; impurities, 4·76):—Sample-box 1, in 100 parts—Sugar, 92·90; water, 2·28; impurities, 4·86. Sample-box 2—Sugar, 91·90; water, 3·30; impurities, 4·80. Sample-box 3—Sugar, 92·40; water, 2·88; impurities, 4·72. Sample-box 4—Sugar, 91·90; water, 3·31; impurities, 4·79. Sample kept in tinned-iron box—Sugar, 91·80; water, 3·50; impurities, 4·70. Sugar kept in glass-stoppered bottle—Sugar, 91·70; water, 3·52; impurities, 4·78.

Reagent to Detect the Presence of Resin of Guaiacum among Resin of Jalappa.—M. Blacher.—When 50 centigrms. of pure and pulverised resin of guaiacum are mixed in a porcelain mortar with 20 centigrms. of black oxide of copper and about twenty drops of alcohol (not methylated spirits), nothing noteworthy is exhibited; but if to this mixture some fifteen drops of liquid ammonia are added, and trituration continued, there will be seen, within a minute, a beautiful apple-green colour. If this experiment is repeated, with the same quantities of material, but pure resin of Jalappa taken instead of the resin of guaiacum, the original brown colour of the latter remains predominant, and no greenish or bronzy colouration ensues. The quantities mentioned are not absolute, but the author thinks it best not to depart, in either more or less, from the same. There is formed a *guaiacinate ammoniaco-cuprique* (ammoniacal cupro-guaiacinate).

Nutritive Value of Divers Roots used as Cattle Food and for Sugar Manufacture.—M. Corenwinder.—The author has estimated the quantity of nitrogen contained in the following roots, and found that to amount, percentically:—In yellow beet-roots, 1·087 sugar beet-root, 1·044; rutabaga, 1·41; pulp of sugar beet-root, expressed by Champonnois process, 1·36. What rutabaga is is not explained. Although not an absolute criterion, the quantity of nitrogen contained in vegetables of this kind expresses fairly their average value as food, taking the other constituents into consideration.

Method for Staining Naturally White-Coloured Woods.—M. Mène.—When naturally-white-coloured woods are painted over with a concentrated aqueous solution of permanganate of potassa, which is best kept somewhat warm (tepid), it is possible thereby to give such woods the appearance of palissander or walnut wood. Different kinds of wood behave with this solution in different manner; the wood of pear and cherry trees is rapidly stained; white woods, as, for instance, the acacia (*Robinia pseudo-acacia*), resists a longer time; and resinous woods, like fir, are more difficultly acted on. The rationale is that the permanganate of potassa is decomposed by the woody fibre; brown peroxide of manganese is precipitated and fixed by the potassa, which is afterwards removed by washing with water. The wood, after having become dry, is varnished, and is, according to the author, not readily distinguished from naturally-dark-coloured woods.

NOTES AND QUERIES.

Halliday's Machines.—"A. W. N." will find, we think, the information he desires in Richardson's, Knapp's, and Watts's work on "Chemical Technology."

Bleaching Syrups.—Can some of your readers give me the following information:—What will bleach syrups (common sugar-house syrup) without expensive apparatus? Will animal charcoal effect the object to any degree?—Andrew van Bibber, Cincinnati, October 14, 1869.

Rendering and Bleaching Tallow.—(Reply to "A Tallow Melter.")—This correspondent is referred to Richardson's, Knapp's, and Watts's work on "Chemical Technology;" to Chevreul's work on Fats; and to Wagner's "Lehrbuch der Chemischen Technologie." There is a French publication on the subject in the useful series known as the "Encyclopédie Roret," published at Paris.

Tungstate of Soda, &c.—(Reply to "J. C.")—This article is not manufactured in such large quantities as to require special makers—some few manufacturing chemists make it, and also the tungstate of chromium; but we cannot name any who do so continually. If "J. C." wants these articles, he should either apply to those who sell chemicals, or to some manufacturing chemist, whose names can be found in directories.

Footpaths.—"Roadway" will find one part of Portland cement, mixed with seven or eight parts of gravel, or old hard durable rubbish, such as brick-bats, broken stones, or gravel, to make a cheap, neat, permanent, garden walk, impervious to wet, heat, or cold. I will give your correspondent any information he needs if he sends his address to me through you.—Nemo.

Footpaths.—(Reply to "Roadway.")—Your question is one which belongs to civil engineering, rather than chemistry; you do not state a very important item—viz., the natural soil you wish to make a footpath on. A very good and, comparatively, cheap footpath may be made by laying down, first, a layer of rather coarsely broken-up old bricks, next, some middling coarse gravel, and over that a layer of from 2 to 4 inches thickness of small sea-shells (bivalves). If care be taken to beat or roll the broken-up bricks and gravel well into a solid mass, the shell-covered surface may be advantageously rolled in with a heavy iron roller, and will be found to form, even on soft sub-soil, a durable and inexpensive roadway. On the continent, at least in Belgium and the Netherlands, many roadways, *chemins vicinaux et communaux*, are thus arranged, and stand moderate horse and carriage traffic admirably well. Care should be taken for the proper drainage of such roads.

Bichromate of Potash.—In answer to "Bichrome," in your last number, this article is made by Norris, Brothers, Sowerby Bridge, near Halifax; The Conacher Quay Chemical Company, 121, Newgate Street, London; by a Company at Drontheim, in Norway; and also at Baltimore, U.S. If your correspondent wants further information, and writes to me under cover to you, I will ascertain the other addresses.—Nemo.

Terra Alba.—"Selenite" thanks "Nemo" for information given and offered, and would ask further—Is any particular variety of gypsum preferred? what is the nature of Jullien's process? what precipitation is meant? how is drying effected? is the patent English? Also—If the purest gypsum answers, why the artificial product? what is the difference in cost of production of native and artificial? why is French better than English terra alba? any objection to mention uses of material?

TO CORRESPONDENTS.

Metallurgist.—(1) The latest and most complete treatise on Metallurgy is the English adaptation of Kerl, by Crookes and Röhrig; vol. i. 31s. 6d., and vol. ii., 36s., are published, and vol. iii. is in the press. (2) Mitchell's "Manual of Practical Assaying," edited by William Crookes; price 28s. These works can be obtained at our office. (3) A knowledge of your qualifications would be necessary to answer your other questions.

THE CHEMICAL NEWS.

VOL. XX. No. 520.

ON THE

ACTION OF CHLORIDE OF ZINC UPON CAMPHOR.

By M. ADOLPH ROMMIER.

ACCORDING to Gerhardt, when camphor is distilled over chloride of zinc, it changes into cymol and water, according to the following equation:—

$$C_{20}H_{16}O_2 = C_{20}H_{14} + 2HO.$$

MM. Lippmann and Longuinine,* Fittig, Koebrich, and Silke,† found great difficulty in preparing cymol from camphor, and observed during the reaction the formation of hydrocarbides homologous with benzol, which was also proved by ourselves upon repeating the experiment. Our experiments were made upon 2 kilos. of camphor, which when distilled four times over fused chloride of zinc, yielded about 700 kilos. of essence, which boiled at from 140° to 240°, and of which scarcely a tenth approached the boiling point of cymol. It was also ascertained that this essence, mixed with a solution of caustic potash, yields a product analogous to phenol. After precipitation by chlorhydric acid, 40 grammes were obtained, which, on distillation in a current of carbonic acid, yielded a small quantity of liquid, boiling below 200°, and the rest at a temperature somewhat higher. Here is the elementary analysis of this latter product:—

	Experiment.	Calculation.
Carbon	76·87	77·77 (C_{13})
Hydrogen	8·13	7·40 (H_8)
Oxygen	15·00	14·83 (O_2)
	100·00	100·00

figures which correspond to cresylic alcohol.

The first was too hydrated for analysis; it was merely heated with oxalic and sulphuric acids, and the formation of rosalic acid proved characteristic of phenic alcohol.

These phenols have a slight but decided smell of phenic alcohol, whilst cresylic alcohol, obtained from tar, has a very disagreeable odour, being less easily purified than that obtained from camphor. Finally, in the reaction of chloride of zinc upon camphor, the formation of the sundry hydrocarbides and phenols shows that, contrary to what was believed, decomposition with deflagration ensued rather than simple dehydration, since if the experiment was carried on at a low temperature, the camphor distilled without alteration, whilst if the temperature was raised to the fusing point of the chloride of zinc, a still greater quantity of camphor remained unaltered even after four distillations.

ON ARTIFICIALLY-COLOURED WINES.

By Dr. T. L. PHIPSON, F.C.S.

WHEN wine of any vintage is found to be wanting in colour, it is customary to mix it with a certain proportion of strongly-coloured wine grown in the South; for instance, with good Roussillon, &c. At Fismes and Poitiers, and probably in other parts of France, there exist, however, regular establishments where colouring-matter for wines is manufactured on a somewhat extensive scale. And in Greece the flowers of the purple Holyoaks (*Althæa rosea, Malva arborea, Rose tremiere*) are collected for the like purpose to a considerable extent.

The material manufactured at Fismes is obtained from elderberry, both from the fruit of *Sambucus niger* and *S. ebulus*. The process is very simple. 250 to 500 parts of this richly-coloured fruit, with 30 to 65 parts of alum, and 600 to 800 of water, are the proportions generally employed. It has been stated that beet-root juice, blackberries, Brazil-wood, logwood, &c., are occasionally used, but, I believe, by no means so frequently as the substances above named.

Many methods have been tried in order to detect the presence of artificial colouring-matters in wines, but, it appears, with a very small amount of success. Œnocyanine may be precipitated from the wine, and its properties, studied with care, will show at once the presence of an adulterating material; but the process is rather long and delicate. I have shown, in a note on the "Absorption Spectra Yielded by Certain Organic Substances,"* that the pure colouring-matter of the grape gives no absorption bands, but only a general absorption, increasing gradually towards the violet; whilst the colouring-matter of the purple Holyoak, dissolved in water containing a little alum, gives a distinct and wide absorption band in the neighbourhood of D. This allows its presence in wine to be detected without much difficulty; and the same method applies equally well to the colouring-matters of logwood and Brazil-wood.

I have not yet ascertained how the colouring-matter of elderberry fruit affects the spectrum, but it is not difficult to discover in wine, according to M. Fauré, by means of gelatine. The fact is that œnocyanine is easily precipitated along with the tannin when gelatine is added to red wine, whilst other colouring-matters (and, among them, that of the elderberry) are left in solution. If there happen to be not enough tannin naturally present in the liquid to precipitate all the œnocyanine, a little more must be added.

Alum will be often found in wine which is artificially coloured; it vivifies the tint, and is supposed to preserve the wine. Its presence is not only highly injurious to the health, but will effectually prevent the ripening of wine and the development of the bouquet.

The test to which I have called attention may be made as follows:—Take a specimen of the wine to be examined, and, if its colour is too powerful when examined in a thin tube by means of the prism, it must be diluted with distilled water until a proper degree of transparency is obtained. A minute quantity of alum is then added, and the specimen examined in the spectroscope. If an absorption band of any kind shows itself, the wine may be suspected.

Analytical Laboratory, Putney, S.W., Nov. 1st, 1869.

ON THE

METHODS OF ANALYSIS AND THE COMPOSITION OF VARIOUS CHEMICAL MANUFACTURING PRODUCTS.

By M. GASTON TISSANDIER.

(Continued from p. 218.)

SALTS OF SODA.

COMMERCIAL salts, or carbonates of soda, are divided into hydrated salts and dry, or anhydrous salts. In most cases, the determination of the alkalimetric standard suffices to show the value of the product. The method of preparing the standard liquid sulphuric acid, which is very important, is as follows:—

* *Bulletin de la Société Chimique*, Nouvelle série, tome, vii., p. 374, 1867.

† *Ibid.*, tome x., p. 78, 1869.

* *Journal of the Chemical Society*, Sept., 1869, p. 324.

Alkalimetric Standard Liquid.—The method which I prefer, and which may be called *méthode des tatonnements*, is as follows:—

Take pure commercial sulphuric acid, and weigh rather more than 100 grms. to the litre, in order to compensate for the proportion of water which is always contained in it. Let us suppose that 10 litres of standard liquid are required; a large bottle must first be gauged, by weighing into it 10 litres of distilled water, and marking the line made by the upper surface of the liquid with a stroke of a file. This done, half the water is poured away, and, to what remains, 1·200 grms. of pure commercial sulphuric acid are gradually added; the 10 litres are then filled up with distilled water. The liquid must now be stirred; and if the acid is of a good quality, the real composition of the normal liquid will be nearly arrived at, for the 200 grms. previously weighed will approximatively compensate the excess of water contained in the acid. The liquid will contain about 100 grms. of SO_3,HO per litre; but a mere approximation will not suffice, as extreme exactitude is indispensable. This first liquid must, therefore, be tested, in order to see whether it is too concentrated or too weak; that is, whether water or sulphuric acid must be added.

The test is easily effected with dry and pure carbonate of soda, which should estimate 92·40°, if the liquid is quite correct. It is a good plan to prepare the carbonate of soda one's self, in the following manner:—Fill, with bicarbonate of soda, a funnel, the lower part of which is provided with a plug of amianthus; wash the salt with water, so as to purify it and to eliminate the alkaline sulphates and chlorides with which it is mixed. When the rinsing-water no longer contains either chlorine or sulphuric acid, the bicarbonate of soda is pure; it must then be crystallised and calcined, when carbonate of soda is produced. To obtain still more exactitude, this is again dissolved, crystallised, and calcined, and it will then be perfectly pure and dry, and should estimate 92·40°.

In testing the alkalimetric liquid, it is a good plan to heat the carbonate of soda before weighing, and even to calcine it slightly, in order to separate the water which it may have absorbed; 5 grms. are then weighed, and their standard taken. If this proves to be too high—say, for instance, 94°—the liquid is too weak, and a small quantity of sulphuric acid must be added. By thus feeling the way, as it were, adding now more acid and now more water, a liquid is easily obtained which will give, in combination with the dry, pure carbonate of soda, a normal standard of 92·40°.

In order to avoid error, it is indispensable that the alkalimetric burettes employed should be scrupulously exact; they should, therefore, be tried—the best way of doing this is by means of the balance. A small precipitating vessel should be tared upon the pan of a sensitive balance, and distilled water poured into it from a burette. If the burette is correct, the volume of water contained between ten divisions, or 5 c.c., must be 5 grms.

Still greater exactitude may be obtained by testing the standard acid with protoxide of lead as follows:—Weigh 20 grs. of pure litharge, and heat them, in a small capsule, on a Gay-Lussac stove at 110°, until their weight no longer decreases; pour in 10 c.c. of the alkalimetric standard liquid, which, if correct, should contain 1 decigrm. of sulphuric acid, SO_3,HO; evaporate the whole to dryness on the stove, and weigh again. The increase of weight should be exactly 0·0816 grs., corresponding to the quantity of SO_3 contained in 0·1 gr. of SO_3,HO.

Too many precautions cannot be used in order to obtain a well-prepared normal liquid, which is of the utmost importance in working analyses. Some chemists are in the habit of estimating the sulphuric acid contained in 5 c.c. of the liquid; for this purpose, chloride of barium is used; and a well-performed experiment on a correct liquid should yield 0·2378 of sulphate of baryta, corresponding to 0·1 gr. of SO_3,HO.

Analysis of Dry Soda-Salts.—We will say nothing concerning hydrated carbonates of soda, which often contain more than 60 per cent of water; it is only necessary to remark that the alkalimetric standard is very important, as it often exposes the fraud of dealers. The method which we are about to describe, for analysing dry salts of soda, may also be applied to hydrated salts.

Weigh 25 grms. of the salt to be tested, dissolve in water, and filter the insoluble substances upon a filter placed above a test-glass gauged to ½ a litre. The liquid ½ litre is divided in the following manner:—

Remove 100 c.c., corresponding to 5 grms., to ascertain the alkalimetrical standard. By stating the equation—

$$\text{Standard, or number of divisions on the burette} = \frac{49(SO_3HO)}{53(CO_2NaO)}$$

the carbonate of soda per cent is obtained. Deduct 50 c.c., to estimate the chlorine, which is transformed into chloride of sodium, and 100 c.c., to estimate the sulphuric acid, which is changed into sulphate of soda. The estimation of the moisture is effected separately in a platinum crucible. Those who wish for a description of the process are referred to former chapters.

Composition of Salts of Soda.

Substances estimated.	I.	II.	III.	IV.	V.
Moisture	2·22	3·11	1·15	1·00	0·40
Insoluble matter ..	0·12	0·22	0·08	—	0·06
Chloride of sodium..	12·48	6·41	3·28	2·11	0·99
Sulphate of soda ..	8·51	3·25	2·15	1·50	0·35
Carbonate of soda ..	76·67	87·01	92·34	95·39	98·20
Total.. ..	100·00	100·00	100·00	100·00	100·00

Salts of soda derived from the refining of beet-root salts always contain a small quantity of potash, which may be easily estimated by means of bichloride of platinum.

Estimation of Caustic Soda.—Salts of soda sometimes contain caustic soda, the proportion of which may be determined in the following way:—

Pulverise part of the specimen finely, throw it into a stoppered flask, into which have been previously poured 100 c.c. of alcohol at a temperature of 40°, and stir vigorously for ten minutes. The alcohol does not dissolve the soda, while at the same time it absorbs the whole of the caustic soda. Filter under a bell-glass, in order to avoid evaporation of the alcohol; collect 50 c.c. of the liquid, which will correspond to 5 grms. of salt, saturate it with the alkalimetric liquid in the cold, adding water and a few drops of sensitive litmus, and the *standard of causticity* will be obtained. This standard allows the calculation of the corresponding quantity of caustic soda, NaO,HO, deducted from the total standard; the difference given will be the standard corresponding to the carbonate of soda.

Composition of Salts of Soda containing Caustic Soda.

Substances estimated.	I.	II.	III.	IV.
Moisture	2·10	1·50	2·48	1·38
Insoluble matter ..	0·12	0·11	0·21	0·09
Chloride of sodium	4·32	2·43	3·50	4·11
Sulphate of soda ..	8·88	1·62	2·15	2·50
Carbonate of soda	82·47	88·09	84·54	81·67
Caustic soda.. ..	2·11	6·25	7·12	10·25
	100·00	100·00	100·00	100·00

Detection of Iron and Sulphides.—Salts of soda destined for the manufacture of glass should be free from iron (which colours the glass), and from alkaline sulphides. Iron may be detected by means of sulphydrate of ammonia, or, which is better, sulphocyanide of potassium, the most sensitive reagent of that metal. If the solution of the salt under examination should contain traces of iron, it will assume a red hue under the influence of some drops of this reagent poured into an acidified liquid. To detect sulphides, boil the salt of soda to be tested in a

flask containing sulphuric acid diluted with water. The liberated sulphydric acid may be known by its smell, or by the influence which it exerts upon paper previously soaked in acetate of lead.

Nitrates of Soda.

The analysis of nitrates of soda requires great care; for the amount of nitrate contained in them is determined by difference.

Estimation of Moisture.—Heat 5 grms. of the specimen on the stove at 120° until they no longer lose weight. The method of the closed tube, previously described, may also be employed.

Estimation of Chlorine.—Nitrates of soda do not usually contain more than from 1 to 1·60 per cent of chloride of sodium; therefore the estimation must be made upon 10 grms. with the silver liquid.

Estimation of Insoluble Substances.—Dissolve 25 grms. of nitrate of soda in water, and separate the insoluble matters by filtration. They, however, occur in but small proportions.

Estimation of Sulphuric Acid.—This is estimated on 25 grms. of nitrate of soda. The filtered liquid is now used for this purpose, having previously served to determine the quantity of insoluble substances. The sulphuric acid is precipitated as sulphate of baryta, and filtered after standing twelve hours.

Subjoined is an example of the composition of some commercial nitrates of soda, and of the way in which it is usual to formularise the analytical results obtained.

Loss per cent.	I.	II.	III.	IV.
Moisture	0·98	1·11	1·42	1·68
Insoluble matters	0·07	0·12	0·16	0·15
Chloride of sodium ..	0·99	1·10	1·41	1·60
Sulphate of soda	0·18	0·20	0·22	0·25
Total loss	2·22	2·53	3·21	3·68
Nitrate of soda	97·78	97·47	96·79	96·32
Total..	100·00	100·00	100·00	100·00

The quantity of water contained in nitrates of soda rarely exceeds from 2 to 2·50 per cent. The proportion of nitrate of soda varies between 95 and 99 per cent.

(To be continued).

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 221.)

The durability of objects, however mounted, is much influenced by the manner of storing them. Racked boxes and drawers are the worst possible receptacles as from the vertical position of the slides they are liable to serious injury, those in fluid being likely to become leaky, and the balsam specimens sliding down, frequently, cover and all. Arrangements should be made for keeping the objects flat, which is now always done in well constructed cabinets; it is also a great advantage to be able to see every slide, which is impossible in a racked box, and often causes much loss of time in searching for an object. For the convenience of those for whom the usual cabinets are too costly, Mr. Piper has invented some very ingenious trays, in which slides are placed horizontally; besides the merit of cheapness, they have the advantage of being extremely convenient. Five or six of these trays, with a mill-board at the top and bottom, may be fastened together with a couple of India-rubber rings, and any vacant shelf room utilised for the storage of objects; a similar bundle of two or three trays is very convenient for carrying a small selection of objects in the pocket. Dr. Carpenter has used these trays placed in wooden cases made to resemble books, a very convenient way when bookshelves are vacant to receive them.

The chief difficulty of fluid mounting will be found not to consist so much in the mechanical process of closing the object perfectly in its cell, as in the selection of a fluid suitable for its preservation.

A fluid which may be considered as a perfect medium—that is, one capable of preserving substances for an unlimited period without change, is at present unknown, and it is more than doubtful whether the discovery of such a fluid would be altogether an advantage, as use is frequently made of what some may consider the defects of preservative fluids, the alterations they induce in tissues submitted to their action often revealing facts of great importance. Some media are valuable, because they soak into tissues and render them transparent; this is the case to such an extent with glycerine, that Dr. Beale very appropriately calls it "The Canada balsam of moist tissues." Others are used for quite the opposite purpose, because they induce opacity, and very frequently do so partially, bringing out details somewhat in the same manner as is done by the colouring of a map, and which, without such aid, would be very imperfectly distinguished. Others are slightly corrosive, and clear away parts wished to be got rid of for the sake of bringing others more prominently into view.

In mentioning some of the very numerous media which have been used for mounting, the results can only be stated generally, and no fixed set of rules can be given, as the whole subject is at present in too imperfect a state. Much good might be done by observers mounting a series of the same object in different media, carefully labelling each slide with the date of mounting and the nature of the medium employed, and from time to time noticing and recording the result.

One of the great difficulties affecting the mounting of objects in fluid, arises from endosomotic action. When two fluids of different densities are separated by a permeable membrane, they will pass through and mix at very unequal rates. Supposing some dense fluid, like glycerine, enclosed in a bladder and immersed in water, the water would flow into the bladder faster than the glycerine made its way out, the result would be the expansion of the bladder. This is called endosmosis: the reverse action is known as exosmosis. With a view to observing practically the result of these actions, the student is recommended to obtain a specimen of some fresh-water conferva, such as are abundant in nearly every pond or aquarium. A portion of this conferva should be placed on a slide in a drop of water, covered with a thin glass, and examined with a power of fifty or sixty diameters. When the appearance of the plant is well impressed on the mind, remove the slide from the microscope, take off the cover glass from the object, and with a piece of blotting-paper drain off (not blot up) as much of the water as possible. Now cover the conferva with some strong glycerine, replace the cover quickly, and examine without loss of time under the microscope, and notice the change that has taken place. The fluid contents of the

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

conferva cells have suddenly emptied themselves into the surrounding glycerine, leaving the whole plant in a shrivelled and contracted state; in many cases the cells will be found to be ruptured, but those which have escaped injury will after a time expand and resume their natural appearance. In observing, advantage is sometimes taken of induced endosmosis, the tissues ruptured by this means often revealing points of structural detail difficult or impossible of demonstration by dissection. Endosomotic action may be prevented by introducing objects which contain light fluids very gradually into denser ones; for instance, an object should be passed from water into weak glycerine and then after a time into stronger, till at last it might be placed in glycerine of full strength without any contraction taking place. The same phenomenon takes place if marine plants are immersed in fresh water. This may be familiar to some who have attempted to wash delicate sea weeds, such as *Griffithsia setacea* in fresh water, the result being that the cells burst and stain the mounting paper; this may be prevented by washing in sea water, or water having gum or sugar dissolved in it, so that its specific gravity approaches that of sea water. An ingenious application of the principle of gradually increasing the specific gravity of the mounting fluid with a view to the prevention of endosmosis, will be found in the method known as Hantzsch's. The fluid consists of three parts alcohol, two of distilled water, and one of glycerine (Price's), all by measure. This medium is principally imployed in mounting *Algæ*. The specimen is placed in the cell with this fluid and the cover put on, but not cemented, so as to allow evaporation to take place; the waste is supplied from time to time, until at last the cell contains nearly pure glycerine; it is then to be cemented as before described. The fluid is of very nearly the same specific gravity as water, so little or no endosomotic action takes place on the immersion of the specimen; and as the evaporation process increases the strength of the solution very gradually, the most delicate tissues can be eventually mounted in strong glycerine; doubtless this principle would answer equally well with a solution of chloride of calcium, a very valuable medium for certain preparations. Much valuable information respecting the collection and preparation of *Algæ*, will be found in "The Collector's Handy Book of Algæ," by Rev. W.W. Spicer, from which the above process is taken.

Taking the preservative fluids in groups, the simplest consist of water, either alone or in combination with some antiseptic substances.

Distilled water alone is capable of preserving such objects as the *Desmidiæ* and other *Algæ* in tolerable perfection as to form, although with more or less loss of colour and alteration of the disposition of the endochrome or cell contents. Confervæ are very apt to grow in slides in which distilled water is used; this is best prevented by saturating the water with camphor or creosote.

Camphor water is made by placing a lump of camphor in a bottle of distilled water, and allowing it to remain a few days; the water will then be found to smell very strongly, although the quantity dissolved is exceedingly small. Such portion as may be required for use is to be filtered and kept in a small bottle; the store bottle is to be filled up from time to time with distilled water. This fluid may be used with advantage in making and diluting all the preservative fluids mentioned in these papers instead of pure distilled water, unless an indication to the contrary is given in the formula. It is capable of preserving animal tissues as well as vegetable, but with the fault of most watery liquids, that it is apt in time to induce a granulous texture in objects of this kind mounted in it.

Creosote water is made in a nearly similar manner; a few drops of creosote are poured on a quantity of precipitated chalk, and the whole shaken up in a bottle of distilled water. When the chalk has settled, the clear liquid may be poured off and filtered as required for use; the preservative properties of this and also of a very diluted solution of carbolic acid closely resemble those of camphor water. For another use of carbolic acid see paper by Dr. Bastian, before quoted (Chemical News, vol. xx., p. 96.)

Alcohol diluted with water, in various proportions, is much used for the preservation of large anatomical specimens; portions of injected tissue to be viewed as opaque objects keep very well in it, also vegetable structures where loss of colour is not objectionable. The striated structure of muscular fibre is well shown when this medium is employed; a piece of cooked meat will do to experiment upon. The fibres should be well separated with the needles before the cell is closed. Many other preparations are used for the preservation of objects.

Thwaites's Fluid.—Water, 16 ozs.; alcohol, 1 oz.; creosote and chalk, as in creosote water. Pour the creosote on the chalk as before, add the alcohol, stir up the whole, and add the water very gradually; allow the mixture to stand a few days, and then filter. Dr. Beale found that this solution was liable to become thick after a time, and gives the following substitute in his "How to Work with the Microscope:"—"Creosote, 3 drachms; wood naphtha, 6 ounces; distilled water, 64 ounces; chalk, as much as may be necessary. Mix first the naphtha and creosote; then add as much prepared chalk as may be sufficient to form a smooth, thick paste; afterwards add very gradually a small quantity of the water, which must be well mixed with the other ingredients in a mortar. Add two or three small lumps of camphor, and allow the mixture to stand in a lightly-covered vessel for a fortnight or three weeks, with occasional stirring. The almost clear supernatant fluid may then be poured off and filtered if necessary; it should be kept in well corked or stoppered bottles." Dr. Beale states that he has had large preparations preserved in this fluid for more than twelve years, and that it is still bright and colourless.

Fluids are filtered by being strained through a conical bag made of a circular piece of porous paper manufactured for the purpose, folded in the usual manner, and supported in a glass or porcelain funnel of suitable dimensions. If the proper filtering paper is not at hand, white blotting paper will answer the purpose.

Chloride of Calcium (a saturated solution in camphor water.)—For making this solution, the pure fused salt should be used, and not the common kind used for drying; it should be carefully filtered before use; it can be diluted to any extent with camphor water. The saturated solution is an extremely valuable preservative fluid; it soaks into objects, rendering them transparent, but rather less so than strong glycerine; it has the advantage, also, of not injuring calcareous tissues. Insects, viz., fleas and lice, mounted whole in this medium, with little or no compression, show the tracheal system and many of

the internal organs remarkably well when properly illuminated, and are still in perfect condition; date of mounting, 1866. Flax, hemp, and other similar fibres display their structure far better in this than in any other medium, the secondary deposits being very clearly brought out.

Diluted Solution.—One part of saturated solution to ten of camphor water, answers well for the preservation of the fresh-water *Algæ*; the green colour is better preserved by it than it is in any other fluid.

Chloride of Sodium (common table salt).—A saturated solution seems to preserve *Entomostraca* very well indeed; it induces a slight degree of opacity, which is sometimes an advantage. Specimens of *Daphnia pulex* (water fleas) mounted in it in September, 1866, show much of the internal structure; the eyes and bundle of optic nerves are in very perfect condition. This solution is of value from its being readily procured anywhere, and a supply of specimens which would otherwise be lost may be preserved in it. Sea water impregnated with camphor or creosote will reserve various delicate marine animals and plants extremely well and without injury from endosmosis; by taking proper precautions they may be gradually transferred, if necessary, to strong glycerine.

Solution of arsenious acid in water has been used both alone and in combination with glycerine for the preservation of objects; the latter mixture has answered very well in re-mounting a series of injected preparations, which are now, after a period of about six years, in perfect condition. The quantity of arsenic capable of being dissolved in water is extremely small; solutions of arsenic, unless saturated with camphor, are especially liable to confervoid growths, a rather unexpected phenomenon in so poisonous a fluid.

(To be continued.)

THE CHEMISTRY OF THE BLAST FURNACE.*

By I. LOWTHIAN BELL.

My attention has just been directed to a translation of an article in your journal by Mr. C. Schinz, of Strasburg, entitled "The Chemistry of the Blast Furnace according to Mr. I. L. Bell's Experiments." In a subject, the investigation of which is attended with so many practical difficulties as this, we can scarcely hope to discover the exact truth at once, and I think I can now amend—indeed, I may say, I have in a recent paper amended—to a small extent, the views communicated to my colleagues in the Chemical Society of London, in the paper of which the article in question is a criticism. I shall at all times be glad to have my opinions freely canvassed; but in the present instance Mr. Schinz has overlooked those minor parts of the inquiry in which I have probably erred, and attacks me in language a little more forcible than is perhaps strictly necessary upon matters where I hope to show the fallacy is all on his side.

In my discourse to the Chemical Society, I expressed a dissent from the view which maps out a furnace into zones of strongly defined dimensions, and gave my reasons, one of which was the irregularity of the size of the pieces introduced into its interior. Mr. Schinz says this mode of charging a blast furnace is a mistake often committed in England. I said nothing to the contrary; I am dealing with the effect, not with the cause, and leave the practical smelter to discover whether the saving in fuel by a different mode of procedure will pay for the expense incurred in its adoption. I have stated elsewhere† that where such an expensive fuel as charcoal is employed, more care is taken in this item than with us, but observation in almost every iron-producing country in Europe enables me to challenge Mr. Schinz to name one instance where the approach to uniformity of dimensions in the materials is usually such as he would have us suppose.

The measurement of temperatures of the escaping gases of blast furnaces is assumed as being founded "upon a delusion;" because, as this gentleman observes, pieces of metals such as I employed laid on the bottom of the gas pipe, will, from their superior conducting power, not be melted by reason of their contact with the cool pipe, while ore exposed to the current of hot gases, will, from its less conducting power, acquire a temperature superior to that indicated by the non-fusion of the test metals. Now there is not one word in my paper to justify any such inference as to the mode followed in estimating the temperature of the gases; for it happens the specimens of ore operated upon in the experiments quoted were suspended by a thin rod on a tray 2 or 3 feet from the side of the gas pipe and the metals intended to denote the temperatures were placed on the same tray (6 inches square), so that all must necessarily have been equally heated. Besides, Mr. Schinz might have given me credit for more care in obtaining my data, seeing I mention the use of three different kinds of pyrometer, not one of which could, without great difficulty, have been applied in the blundering way he suggests.

But, continues this chemist, if my observations as to temperature are true, "my conclusion" is still only delusively correct, "because reduction is accelerated by proportionate quantity of gas, by the amount of carbonic oxide such gas contains, and by its temperature." Before Mr. Schinz undertook to correct me, I had published an account of experiments* undertaken to show how these three conditions affect the rapidity and extent of reduction, but neither of these phenomena is in question in the present discussion. Former experimenters had given the results of their observations as to the temperature at which reduction *begins* in a blast furnace, and I gave the grounds for respectfully dissenting from opinions entertained by such eminent men as Tunner, Ebelmen, and Scheerer.

Mr. Schinz then proceeds to pass an opinion upon Tunner's analysis of the gases of the Wrbna furnace, which he says is "decidedly wrong," and then observes that the composition given of the gas of one of the Clarence furnaces is "just as false."

I may fairly leave the reputation of my friend, Professor Tunner, as a correct observer, to stand upon its own merits, and reserve my observations for pointing out to Mr. Schinz what is really involved in his somewhat gratuitous observation respecting the analysis of the Clarence gases. I quote the results obtained as they are given in my paper:—

Volumes in 100 Volumes.	CO_2		CO		N by Difference.	
Hour of taking Sample, p.m.	1st Trial.	2nd Trial.	1st Trial.	2nd Trial.	1st Trial.	2nd Trial.
1.0	6·25	—	26·30	—	67·45	—
1.55	6·24	6·70	34·70	—	59·06	—
2.15	6·94	6·73	34·40	35·40	58·66	57·87
3.0	5·30	5·75	35·80	35·64	58·90	58·61
3.15	4·75	5·12	31·00	30·25	64·25	64·63
3.55	5·91	—	31·12	—	62·97	—
4.20	5·82	6·00	29·72	28·90	64·46	65·10
Average being	5·88	—	31·86	—	62·26	—

Now, if the above figures had been obtained by an incompetent operator, one would have expected to have found discordant results upon the repetition of the analyses, and there being no evidence whatever of this, the

* Communicated by the Author simultaneously to the CHEMICAL NEWS and *Engineering*.

† Paper on our foreign competitors in the iron trade.

* Paper read at Middlesbrough meeting of Iron and Steel Institut September, 1869.

word "false," used by Mr. Schinz, has, to my mind, a somewhat unpleasant sound.

To its application, however, I must submit, if this gentleman is correct in his assertion that furnace gas, having a composition like that given, is "almost impossible;" for he proceeds to show how, taking the nitrogen as the basis of his calculation, the quantity of oxygen, and hence of carbon, are incompatible with the ratio in which the first two elements exist in the atmosphere, having, of course, regard to the oxygen in the ore. In the estimate which has to prove how false my data are, Mr. Schinz assumes that the sole sources of oxygen are the blast and the ore, for he never gives a thought to the *limestone*. Now this is the less excusable, seeing that in the very next page in my paper, the theoretical composition of furnace gases is compared with that furnished by analysis, and the sources of each of the constituent parts are given, among which the limestone is distinctly mentioned. I shall not trouble you with all Mr. Schinz's figures, but content myself with giving a statement, by which it will be seen how nearly the analysis agrees with what the furnace was using at the time the gases were collected for the examination, assumed by this gentleman to be so incorrect.

The consumption for each ton of iron at the time was:—

	cwts.
Coke	29·50
Limestone, calcined, and containing about 22 per cent of carbonic acid	15·50
Ironstone	49·50
The coke contained of carbon	27·14
„ „ ash, moisture, &c.	2·36
	29·50

The carbon which would be volatilised was:—

That contained in the coke	27·14
„ „ limestone partially calcined	0·93
	28·07
Less that to combine with the iron	0·74
	27·33

The gases of which the volumetric analysis is objected to by Mr. Schinz had the following composition:—

By volume.	By weight.		
CO_2 5·88	8·94	Carbon	15·65
CO 31·86	30·82	Oxygen	24·11
N 62·26	60·24	Nitrogen	60·24
100·00	100·00		100·00

From these proportions, the gases for each ton of iron will consist, by weight, of—

	Cwts.		Carbon.	Oxygen.
Nitrogen	105·20		—	—
Carbonic oxide ..	53·83	=	23·07	30·76
Carbonic acid ..	15·61	=	4·26	11·35
	174·64		27·33	42·11

Thus, then, 42·11 cwts. of oxygen are associated with the 27·33 of carbon set out with as having been volatilised. For this we have oxygen accompanying the nitrogen found

	cwts.
In the gases, which would be—105·20 × ⅓	31·42
The iron in 20 cwts. of pig is 19 cwts., which, as peroxide, is equal to oxygen	8·14
Oxygen combined with 0·93 carbon in the carbonic acid of limestone	2·48
	42·04

instead of 42·11, which will probably be accepted as a nearer approximation to truth than the words "almost impossible" would seem to convey.

The actual numbers objected to by Mr. Schinz were CO_2 6, CO 32, N 62, which was merely the volumetric composition of a mixture made for the purpose of comparing its effect in deoxidising iron ore with that of a second mixture, made to resemble the gases of the Wrbna furnace. These numbers, it will be perceived, closely resemble the analysis just examined.

This omission of limestone, as contributing to the constituents of the furnace gases, is repeated by Mr. Schinz when he examines my comparison of the gases produced by the use of hot and cold air in Wales, neither of which, it is expressly stated, were analysed, but assumed as resembling those of the Clarence Works for the sole purpose of estimating the quantity of heat carried off by their means.

In these instances, the gases were considered as consisting, by weight, of CO_2 9, CO 32, N 59; numbers which differ but slightly from those deduced from the analysis of the Clarence gases, as formerly stated.

I find I have made two errors in the calculation based on this assumption. The weight of gases from the cold blast

	CO_2.	CO.	N.	HO.	Total.
furnace should be ..	18·20	64·70	119·40	3·93	206·23
instead of, as formerly	18·19	64·73	124·60	3·93	211·45
and from the hot blast it should be	13·50	48·10	88·60	3·06	153·26
instead of, as before	12·94	46·22	92·73	3·06	154·95

The difference, however, between these two sets of figures is so small as not materially to affect the conclusions drawn from them; but Mr. Schinz arrives at a very contrary opinion by changing the weight of nitrogen, given above in the case of the cold blast furnace, from 124·6 to 142·6, and, not satisfied with this mistake, commits another in the arithmetic used in working out the result from the hot blast furnace, by which he makes the ratio of the volumes of carbon vapour and oxygen per 100 volumes of nitrogen to be 35·82 of carbon and 41·22 of oxygen instead of 29·4 and 33·8 respectively.

In alluding to my remarks on the hot blast, Mr. Schinz (*apropos* of nothing I said) mentions that, "with cold blast an increase of fuel will always yield a product richer in carbon graphite, whilst an increase of temperature by means of the hot blast will never secure the same success." All I can say is the experience of twenty-five years with blast furnaces and that gained by a constant study of a present annual make of 120,000 tons of iron has produced no such impression on my mind. Neither am I disposed to accept as a "solution of the problem relating to the wonderful effect of the hot blast," Mr. Schinz's explanation, who considers solid carbon and not carbonic oxide as the reducing agent.

If my experiments are "worthless," the calculations of Mr. Schinz are not of a very accurate order, for he founds an estimate of heat units supplied to a furnace on the assumption that 113 kilos. of carbon require 3881 kilos. of air for conversion into carbonic oxide, whereas it ought to be 655 kilos. and equally so is his calculation which proves hot blast iron to require more fuel than that smelted with cold air.

I am censured, too, for not being able to distinguish between height and capacity in referring to the economy in fuel effected by a change in the dimensions of blast furnaces. My language may be defective in clearness, but it seemed to me that when I stated that the Lilleshall furnaces saved coal by an addition of 21 ft. to their height, none but a very fastidious critic could have imagined this alteration in form to have been made without their capacity having been increased to a corresponding extent.

There is little in Mr. Schinz's review of my work I am disposed to assent to, but I am unwilling to trespass further on your space, which I have been induced to do at some length in order that the Fellows of the Chemical Society, who honoured me by an invitation to give an address on applied chemistry, should not think I had complied with their request in the negligent manner this gentleman would have them believe.

Washington, Durham.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 4th, 1869.

Sir Benjamin C. Brodie, Bart., F.R.S., in the Chair.

The minutes of the previous meeting having been read and confirmed, the following certificates were read:—

For the first time—Sir Roderick Impey Murchison, Bart., Belgrave Square; John Wiggin, Pharmaceutical and Analytical Chemist, Ipswich; George Harrison, Analytical Chemist, 26, Havelock Square, Sheffield; Thomas Walton, M.R.C.S., and L.S.A., Lecturer on Chemistry at the Hull and East Riding School of Medicine, Kingston-upon-Hull; Edward Smith, Practical and Pharmaceutical Chemist, Strand, Torquay; G. Manley Hopwood, 22, Grosvenor Square, All Saints, Manchester; Thomas Gibb, A.R.S.M., Engineer; Matthew H. Cochrane, 108, Paul Terrace, Glasgow.

For the second time—E. S. Blackwell, Analytical and Consulting Chemist, 6, St. Sacrament Street, Montreal, Canada.

For the third time—Alfred Dudley Keightley, Gatcheck Gunpowder Mills, Old Hall, Milnthorpe, Westmoreland; W. Fletcher Barrett, Lecturer on Physical Science at the London International College; John Morrison, Analytical Chemist, County Wicklow, Ireland; Temple A. Orme, Teacher of Chemistry and Experimental Physics in University College School; W. G. Lewis, Fellow of Oriel College, Oxford.

The last-named gentlemen were ballotted for and duly elected. Mr. Gerstl was elected an Associate of the Society.

The Chairman said the first business before the Society was to consider a paper "*On the Atomic Theory*," which had already been read before the Society by Professor Williamson. This theory was not to be regarded as a fixed and definite system of ideas, but one that had undergone great variation and change. There was the atomic theory of Dalton; then that of Berzelius, and also, in a certain sense, that of Laurent and Gerhardt; and now they had come to a further form of this theory, in which new ideas had arisen in regard to the nature of atoms and their properties; and he (the Chairman) thought it would greatly facilitate the discussion if Dr. Williamson would explain what was the precise form of the atomic theory which he was prepared to maintain and defend, and how they might discriminate that from other forms of the theory which were neither reasonable, nor rational. First, there was the question whether there were atoms at all; then, being atoms, what those atoms were, and whether they were endowed with the properties assigned to them in regard to their replacing power, and to what was termed, their value.

Professor Williamson, on rising, said that he did not admit that, among chemists, there had been several atomic theories. If there had been, he had yet to learn of them. There had prevailed, he believed, from time immemorial, a belief that matter was built up of small particles; and he might also say that no contrary opinion had ever been embodied in any definite form. Dalton doubtless looked for evidences of what he believed to be true, and saw, in the simple multiple proportions which he specially alluded to, facts which were in accordance with that preconceived conviction; but his was the mere germ of an atomic theory, and the changes which have taken place in it since are consistent with the original notions. The very rapid changes had, in the main, been additions to the starting-point given by Dalton. The line of work so vigorously pursued of late years by many chemists, regarding the order in which atoms are arranged in their compounds, was mentioned by the speaker. His endeavour had been to put together more fully than had been done of late what is known of the chemical evidence; firstly, respecting the limits to the divisibility of matter, and, secondly, with regard to the properties of those finite particles which constitute the limits of divisibility, solely from the point of view habitually employed by chemists in their ordinary working. He had also endeavoured to separate those conclusions which appeared to him warranted by facts from everything else. Whether the smallest particles of matter had a spherical form or not, whether they were in their nature indivisible, whether they were in reality the ultimate atoms of matter, or like the planets of this system, he knew not, nor did such questions exist for him as a chemist. He therefore thought it wise to exclude them, important as they were, from the actually existing atomic theory. The work of Berzelius was perhaps the most significant transition from the original notion of Dalton. Silently these atoms had been accepted by chemists, and the whole course of investigation had been one grand confirmation of the assumption that compounds must have molecular weights corresponding to at least the smallest atomic proportion which would represent the actual numbers of analysis. The perfectly independent observations which had been made in reference to: the boiling points of homologous liquids, the phenomena of diffusion, the equality of volumes of masses containing an equal number of these molecules under similar conditions in the gaseous state, all concurred to corroborate the conclusions necessitated by the atomic theory. Thus, independent workmen hewed stones which, when hewn, were found to fit in exactly with the others, forming a perfectly homogeneous whole. Dr. Williamson concluded his remarks by referring to the atomic values, a term which, he thought, represented in a more precise way than some others what is called atomicity; and he also referred to the difference between direct and indirect combination, a fact which he conceived to be essentially atomic in its nature.

Dr. Frankland was not present when Professor Williamson delivered his lecture, and he had only cursorily looked over the printed memoir; but, so far as he could gather, the object of the author had been to establish the atomic theory as an absolute truth. There had been, he thought, so little, if any, opposition to the application of the atomic theory to the phenomena of chemistry, that a discussion could scarcely be raised upon any other feature of the question than that of its absoluteness. He considered it impossible to get at the truth, as to whether matter was composed of small and indivisible particles, or whether it was continuous—the question belonged to what metaphysicians termed "the unknowable;" but he acknowledged the importance of the fullest use of the theory as a kind of ladder to elevate the chemist from one position to another in his science. He was, however, averse to accepting the theory as an absolute truth. Any attempt to realise by its help the action of attractive or repulsive forces upon matter was excessively difficult, indeed to realise such an action through a perfectly void space was to him quite impossible. The same difficulty presented itself to Faraday, who was often obliged to throw on one side, as an obstacle to his progress, this atomic theory. He said that if matter be assumed to be thus composed of solid particles separated by a void space, then, in considering the phenomena of electricity in connection with that view of matter, this space existing between the atoms must be either a conductor, or a non-conductor of electricity. If a conductor, such a thing as an insulator was obviously an impossibility; if it was a non-conductor, such a thing as a conductor was equally inconceivable; so that, apart from chemistry, there were considerations which made it very undesirable for this theory to be represented as an absolute truth. The speaker then referred to the combination which, in certain cases, is effected between gases by the application of heat

and said that, according to the atomic hypothesis, they must assume that the gases, when heated, have their particles driven further asunder; but how, then, could they more readily enter into combination when heated, as was the case with oxygen and hydrogen, and in many other similar instances? No such difficulty presented itself if the gases were regarded as continuous matter. He admired the theory as much as Professor Williamson, and he thought no one could blame him for not making a sufficient use of it; but he did not wish to be considered a blind believer in the theory, or as unwilling to renounce it if anything better presented itself to assist him in his work.

Dr. ODLING, as a chemist, was not particularly interested in the question whether matter was infinitely divisible or not, but he did not think that Dr. Williamson's argument had established that conclusion. Dalton was always spoken of as the discoverer of the law, or doctrine, or theory of combination in definite and multiple proportions, to account for which his invention or adoption of the atomic theory was founded; and he conceived Dalton's great discovery to be better expressed as the law of combination in *reciprocal* and multiple, instead of in *definite* and multiple, proportions. Dr. Williamson had said of chemists that all their modes of thought, and all the government of their actions, was based upon the atomic theory; but he (Dr. Odling) maintained that it was based upon the observed fact that certain bodies combined in certain proportions. Dr. Williamson also argued that the atomic theory was based upon the existence of molecules, and that molecules had no *locus standi* in the absence of the atomic theory. He (Dr. Odling) disputed that position, for the fact that the hydrogen existing in marsh gas was divisible into four parts, and the hydrogen existing in ammonia only into three parts, was, he conceived, a fact quite independent of the atomic theory. The laws of combination, as far as they go, were compared by Sir Humphry Davy to Kepler's laws of planetary motion, which were simply a general expression of observed facts; and, in the same way, these laws of chemical combination were general expressions of observed facts upon which the atomic hypothesis was super-induced.

Professor MILLER thought that Dr. Odling's arguments had not disproved the atomic theory; if they had not the atomic hypothesis, they were entitled to ask what explanation they possessed of the laws of combination? Certain facts were admitted on all hands, as determined by experiment, and when an important and extensive series of facts was ascertained, the endeavour to explain them by some supposition which embraced the facts, and which enabled them to anticipate new ones if possible, was a necessary result of their mental constitution. Unless some hypothesis were accepted, it was absolutely impossible to reason upon the facts; and if they could not adopt this hypothesis as absolutely true, such a view of the constitution of matter explained all the chemical facts that had hitherto been presented. It appeared to him that those who denied the atomic hypothesis were bound to supply something to enable them to interpret phenomena with the same regularity and order as the hypothesis, the accuracy of which they denied and desired to displace. No one would suppose that the absence of an undulatory theory for light would conduce to the explanation of optical science; and he held that what the undulatory theory was to the phenomena of light, the atomic theory was to the phenomena of chemistry.

Professor FOSTER thought the question before them was not so much the utility of the atomic theory as its truth. M. Naumann had stated, in his "Relations of Heat to Chemistry," that, if we assumed that in any compound body the components really occupied distinct portions of space, they must assume that body to be incapable of infinite divisibility. He thought the ideas generally entertained of the existence of the constituents of bodies in compounds were not absolutely necessary ideas. The fundamental phenomena of chemical changes might sometimes be explained by returning to the notion of the actual mutability of matter. By operating upon one portion of matter, it was actually transmuted into another, a qualitative and quantitative relation existing between the disappearing and the appearing bodies. From such ideas as these, they could not deduce the necessary existence of atoms; but all our present modes of expression and modes of thought were founded upon an atomic hypothesis or basis.

Professor TYNDALL sympathised with the ideas of Professor Williamson; his thoughts had, to some extent, been expressed by Dr. Miller, who had made a strong point in referring to the undulatory theory. That theory was something super-induced upon the facts, which might be readily detached from the theory. But it was in the nature of the human mind, it was in the nature of a profound thinker, when pondering upon facts of this nature, to seek for some underlying principle outside the region of facts, from which the facts followed as consequences. Dr. Odling ought to have gone a step further than Kepler; for something that we now call "the theory of gravitation" was certainly super-induced upon his facts, as the atomic theory is upon the facts of multiple proportions. Professor Foster had justly referred to the consideration that a bad theory was very often useful. The emission theory of light was useful in the hands of Newton, Laplace, Malus, and Brewster; but this theory fell, because, in the progress of investigation, facts arose which were inexplicable by it, and which were completely explained by the undulatory theory. The undulatory theory would successfully front all opposition as long as it was competent to explain the facts of optics; and he apprehended that the atomic theory would stand as long as it was competent to explain the facts of chemistry.

Dr. MILLS'S conviction was that chemistry had no facts to support the notion of a limit, and the undulatory theory had an immense advantage over the atomic theory, for the existence of waves was a fact, while the existence of a limit was not a fact. It seemed to be forgotten by many writers that matter might be infinitely divisible, and yet that definite proportions might exist, for between two infinites there might be a finite ratio, so that the atomic theory was not perfectly necessary to chemistry. He believed that motion was the highest generalisation of modern science, and it therefore afforded the only criterion by which all theories, including those of chemistry, must be judged, and the notion of a limit was practically inconsistent with the idea of a motion.

Dr. WILLIAMSON, in his reply, remarked that the benefit accruing from looking at the question from another point of view would be incalculable, and if another view was developed to supersede the present one, he would be among the first to rejoice at it, but he had not to do with the future of this matter. He had endeavoured to put together the actual evidence of the present view, and none of its opponents had been able to find a fallacy in that evidence. He thought it most important to keep the theory at each period of its growth in the modest position which it at present occupies, that of generalising the best-ascertained relations of the elements in their chemical changes.

The CHAIRMAN liked to have clear and definite ideas, as far as he was able to realise them, on scientific subjects, and he was unable to consider even an atomic theory in the abstract. The atomic theory, as he understood, was —that matter is made up of finite particles, the aggregate of which could be divided and subdivided until at last only one particle would remain, and this view might be derived from the perusal and common assent of every work on Chemistry that defined the atomic theory. He thought that such a view as the physical indivisibility of matter must be separated from the facts and basis of chemistry. Dr. Williamson seemed to think the theory and facts were one, but he (the Chairman) asserted that they were two distinct things. He must also express his dissent from the views expressed by Drs. Frankland and

Miller, with reference to the use of a doctrine or theory in which they did not believe. He could not understand using a theory and denying it at the same time. This theory had, he thought, been often the means of deluding chemists into the belief that they understood things about which they knew nothing. He found the works of Kekulé and Naquèt scribbled over with pictures of molecules and atoms, combined together in all imaginable ways, for which he thought there was no adequate reason, and if there was no reason it was a mischievous thing to do. Many students, he believed, thought the pictures in Naquèt's work were chemistry; they did not draw the distinction between the facts and theory of science. His view was that the ultimate constitution of this material universe was one of those things upon which no light had yet been thrown, and he agreed with Dr. Odling when he said that the science of chemistry did not require or prove the atomic theory. They were bound to have some real and adequate means of working at the science of chemistry, and discovering its laws, and they could effect this either through the investigation of the laws of gaseous combination or the study of the capacity of bodies for heat. When they approached the science through the study of gaseous combinations, they discovered that the combining proportions of bodies were capable of being represented by integral numbers, and they also found an analogous fact in studying the capacity of bodies for heat.

The meeting was then adjourned to November 18th.

NOTICES OF BOOKS.

Nature: "*A Weekly Illustrated Journal of Science.*" MACMILLAN and Co., London.

WE are glad to notice the birth of a new popular journal of science. It was never more wanted than now, for it is undeniable that at no previous period has there been such a manifest desire on the part of the general public to understand somewhat of the great scientific discoveries and generalisations which are perpetually springing up around us. Among the objects proposed to be attained by "Nature," is the urging "the claims of science to a more general recognition in education and daily life," and we are fain to believe that there is now amongst us such a movement in this direction, emanating from diverse sources, that the time is not far distant when science will form as much a part of our own educational system as it does of that of other countries.

"Nature" appropriately opens with a series of aphorisms by Goethe; a semi-poetic composition, formed as it were, halfway between prose and poetry, in which an exalted form of prose almost merges into a regular rhythmus. Of Nature Goethe says:—"She tosses her creatures out of nothingness, and tells them not whence they came, nor whither they go. It is their business to run, she knows the road. . . . . Her crown is love. Through love alone dare we come near her. She separates all existences, and all tend to intermingle. She has isolated all things in order that all may approach one another. . . She is complete but never finished. As she works now, so can she always work. Everyone sees her in his own fashion. She hides under a thousand names and phrases and is always the same."

The principal papers are "On the recent total eclipse of the Sun" by J. Norman Lockyer, and "On the fertilisation of Winter Flowering Plants" by A. W. Bennett. There is a review of Madsen's *Antiquités Préhistorique du Danemarch*, by Sir John Lubbock, and of Newman's "British Moths," by W. S. Dallas, and other shorter notices. A paper (read at the last meeting of the British Association for the Advancement of Science), by the Rev. W. Tuckwell "On Science-teaching in Schools" contains a number of very useful suggestions, and will be read by science masters with interest. Professor Williamson furnishes an interesting life of the late Professor Graham, and we wish we could commend the accompanying portrait to a like extent. Mr. Geikie, gives an account of the meeting of German naturalists at Innsbruck. Among other features of the Journal we find several columns of "Notes," containing a chit-chat account of the matters most discussed in scientific circles at the present time. Finally, there is a *resumé* of recent work in all the more prominent branches of science, and of the proceedings of Societies and Academies. We wish "Nature" every success; it is well supervised, its contributors are manifold, and it is issued by an eminent firm of publishers. It will be a healthy sign of the times and of progress, when every educated man reads a scientific journal as regularly as he reads his "Saturday" or "Pall-mall," and to such a result the issue of "Nature" conduces.

MISCELLANEOUS.

University of London.—The following are lists of the candidates who have passed the Second B.Sc. Examination:—*Pass Examination.*—First Division. William Henry Johnson, University College; Alexander Muirhead, University College; William Stephen Ridewood, B.A., private study. Second Division. Phineas Simon Abraham, Trinity College and Royal College of Science, Dublin; William Barnett Burn (First M.B.), St. Bartholomew's Hospital; Dan Isaac Davies, private study; Septimus Peché Moore, LL.B., New and University Colleges; Frederic James Montague Page, Royal School of Mines; Frederick Antony Potter, Royal School of Mines; Charles Thomas Whitmell, St. John's and Trinity Colleges, Cambridge; William Henry Willans, University College and Royal School of Mines.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, November 2, 1869.

This number contains the following original papers and memoirs:—

Industrial Use of Mineral Oils for the Purpose of Heating Steam Boilers, and particularly Locomotive Engines.—MM. St. Claire-Deville and Dieudonné.—This paper gives an interesting account of a series of experiments made by the authors with locomotives upon the French Eastern Line (Paris to Strasbourg), with a speed of 46 kilometres (about 29 miles) per hour, and upon a portion of the line of railway which is by no means level. The consumption of mineral oil was from 3·44 to 5 kilos. per kilometre, over a total distance of 142 kilometres, run over with heavily-laden trains. The authors state that the combustion was very complete.

Heating of Wines.—M. Thenard.—This subject, which has been repeatedly before the meeting, seems to have given rise to some jealousy, as well as captious controversy. The author of this paper, acting upon the principle "*Qui bene distinguit bene docit*," states that M. Appert first discovered the principle, that M. Pasteur has given a proper scientific explanation thereof, and that, lastly, M. Vergnette has been the first man who has industrially applied this principle on the large scale with good success.

Asia Minor.—M. Tchihatcheff.—This author presents to the Academy the last, that is the eighth, volume of his great work concerning a hitherto very imperfectly known part of the globe. This volume comprises the physical geography, climatology, botany, and geology of the above-named country. The author's work is highly eulogised, and is a very valuable contribution to science.

The Chalk of Northern Europe.—M. Hébert.—A lengthy paper on an important geological formation which the author distinguishes according to the presence or absence of some animal remains into groups of different ages.

Chemical Researches of Various Combustible Gases Naturally Occurring in Central Italy.—MM. Fouqué and Gorceix.—The authors have investigated twenty-eight different kinds of gas, collected chiefly in the Appenine mountains between Modena and Imola, including four different kinds collected at the Lagoni, which yield boracic acid. As instances of the composition of these gases, we quote:—Barigazzo—CO_2, 1·58; N, 1·81; C_2H_4, 96·61. Sassuno—CO_2, 1·14; N, 0·39; C_2H_4, 80·60; C_4H_8, 17·87. Gases from the Lagoni:—Larderello—HS, 4·20; CO_2, 90·47; N, 1·90; H, 1·43; C_2H_4, 2·00. Serrazzano—HS, 6·10; CO_2, 87·90; N, 2·93; H, 2·10; C_2H_4, 0·97. This lengthy paper contains a very interesting account of the localities where the gases have been collected, and is a valuable addition to chemical geology.

A Measure which is Not Effected by Change of Temperature.—M. Soleil.—This author proposes (*visum teneatis amici*) to use beryl, the precious stone, as a suitable material for the construction of a standard measure of length, on account of its exhibiting peculiar properties on being submitted to changes of temperature, whereby it is possible that, under certain condition, it will remain invariable. Unfortunately, there are no beryls found of a metre in length, and, therefore, only a centimetre standard could be made.

Constitution and Motion of Glaciers.—MM. Grad and Dupré.—The chief results of the labours of these authors are the following:—The crystals of ice of the glaciers are arranged in a regular manner, and the constituent molecules of that ice are placed as in frozen water. The velocity of motion of a glacier increases from the bottom to the top, while the maximum of motion coincides with the greatest slope.

Heat Reflected from the Moon's Surface.—M. Baille.—According to this author, the moon's surface emits as much heat as a cube filled with boiling water, covered with lamp-black, having a surface of 6·5 square centims., and placed at a distance of 35 metres from the thermo-electric measuring apparatus employed by the author for his experiments.

Synthesis of Guanidine.—M. Bouchardat.—Four volumes of ammonia gas, and one volume of chloroxycarbonic acid, act upon each other with energy, producing chloride of ammonium and urea—

$$C_2O_2Cl_2+4NH_3=C_2H_4N_2O_2+2(NH_4Cl).$$

On repeating this experiment, the author also obtained urea, but simultaneously, divers carbonic acid amides, and especially, also, guanidine. The author has operated with large quantities, no less than 150 litres, of chloroxycarbonic acid at the same time, and has obtained thereby:—(1) Guanidine, the sulphate of which corresponds, in composition, to the formula $S_2O_2(C_2H_5N_3)H_2O_4$. (2) Urea. (3) Melanuric acid, a white-coloured substance, insoluble in water, soluble in weak aqueous solution of caustic potassa, nitric, and hydrochloric acids; formula, $C_6H_4N_4O_4$. (4) Cyanuric acid.

On Chloral.—M. Bouchat.—During the discussion which followed the reading of this paper, it was incidentally mentioned that M. Personne, director of the chemical laboratory of the Ecole de Pharmacie, Paris, had instituted a series of experiments with chloral upon animals, with the result that chloroform was readily detected in various fluids of their bodies, after the administration of chloral.

Anti-Cholera Tissue.—M. Adeline.—This author, or rather manufacturer, having learnt that, from the experiments and experience of Dr. Burq, copper is a certain antidote against Asiatic cholera, presents samples of various woven fabrics, wherein a certain quantity of copper wire is introduced for the purpose of serving as prophylactic.

Phosphorescence of the Sea.—M. Duchemin.—According to this author, that phenomenon is due to electricity, and the infusoria only act as sharp points do in well-known electrical experiments.

Useful Application of Arsenious Acid.—Dr. Lisle.—If the statements of this physician are confirmed, arsenious acid will become a great boon to a large number of people afflicted with that most dire disease, mental derangement. According to this author, arsenious acid, properly administered, even in apparently hopeless cases, restores about 66 per cent of the afflicted to health.

Cosmos, October 30, 1869.

From this number we abstract:—

Extraction of Benzol from Coal-Gas.—M. Meunier.—All coal-gas contains the vapour of benzol, in more or less quantity. By means of cooling mixtures, pressure, and the use of some chemical reagents, as, for instance, strong nitric and sulphuric acids, chlorine, and bromine, benzol may be withdrawn, more or less completely, from coal-gas; it appears, however, that the following simple and effective plan suggested by the author, answers the purpose far better, since it is by a simple application of a solvent that the benzol is obtained:—The gas is made to pass slowly through coal oils (liquid hydrocarbons), the boiling point of which is higher than that of benzol; but it has been ascertained that petroleum, paraffin oils, schist oils, and even fixed fatty oils, will answer this purpose equally well. After a time, these fluids become saturated with benzol, and the latter is obtained by fractional distillation. It should be borne in mind, however, that gas thus deprived of benzol and its homologues loses a great deal of its illuminating power, even so much, in some instances, as to be only fit for heating purposes.

Saccharimetrical Congress at Berlin.—There has just been held at Berlin, under the presidency of the well-known Dr. Scheibler, a meeting of some twenty-five chemists, whose chief occupation is the investigation and analysis of raw sugars. The aim of these gentlemen, to fix upon a uniform method for all quantitative estimations of sugar, and thus to insure good and conformable results, has been accomplished. Special committees have been appointed to investigate everything relating to the optical saccharimetry; one of these committees undertakes to investigate thoroughly the optical power of different thin plates of quartz in reference to pure sugar; another committee, again, is engaged in the preparation of a standard sample of pure sugar, and superintending the manufacture of perfect and uniform optical saccharometers to serve as standards. A central laboratory is to be established, with branch establishments at various localities in Germany.

Temperature of the Human Body.—The average maximum temperature of adults above twenty-five years is 37·25°; below that age, 37·1°. The temperature of the human body is subject to diurnal variation—from 6 p.m. until midnight, the temperature decreases, and increases again from 3 a.m. until 9 a.m.; this variation is, on an average, 0·49°. A thermometer placed under the tongue indicates about 40°.

Guano from the Chincha Islands.—According to what the editor of *Cosmos* states to be reliable information, the quantity of Peruvian guano is so rapidly decreasing that it is no longer difficult to calculate beforehand the period at which there will be no more forthcoming. The deposit of the Guanope islets, which is, however, of inferior quality, will last for some ten years to come. After that period the Lobo Islets may yield some of this manure; but it has been ascertained that the deposit there found is relatively very poor in ammoniacal salts, and contains, moreover, very much sand.

Vulcanised Caoutchouc.—M. Mouton.—In order to give to vulcanised caoutchouc all that softness which is requisite, for instance, for printing-ink rollers, the author reduces ordinary vulcanised caoutchouc to powder, places it in suitably-shaped vessels, and submits it a second time to the temperature required for vulcanisation. By this means it is rendered soft and smooth, has entirely lost its usual harshness, and is fit for various uses—among these the making of durable printing-ink rollers.

November 6, 1869.

This number contains the following original papers:—

Description of an Oven for Burning Pottery and other Ceramic Pastes.—M. Hofmann. The contrivance here alluded to is an improvement upon those hitherto in use, which cannot be continuously used, but are only worked by interrupted periods. The furnace, or oven, here described is, in exterior appearance, somewhat like a large lime-kiln; but its interior construction consists of compartments, separated by double walls made of fire-bricks. The consumption of fuel of these ovens is stated to be small. With a circumference of 120 metres, each compartment of the contrivance alluded to is capable of containing 10,500 bricks; and about 4½ millions of bricks can be annually fired by this oven, with a saving of from 50 to 60 per cent of fuel as compared with the old methods.

Preservation of Telegraph Poles.—M. Delarge.—The preservation of the large number of wooden poles in use for carrying the conducting wires has become a very important subject. The author reviews the use of the following substances employed for the purpose:—*Sulphate of copper.*—On inspection of a large number of poles treated with this substance, it was found that, notwithstanding nearly twenty years' service, the wood was in a very excellent state of preservation; but it should be added that very much depends upon the kind of timber used for the purpose, and upon the period of the year when it is cut down. *Creosote* is very extensively applied, and, according to a series of comparative experiments, purposely instituted in Belgium, during the years 1861 and 1862, the durability of creosoted timber is considered equal to that treated with sulphate of copper. Creosote, however, is found to be, in many instances, very inconvenient, both on account of the odour it emits, and on account of the injury caused by its corrosive action upon the hands of the workmen.. *Chlorids of zinc.*—According to the experience of the Netherlands officers of the Waterstaat, to whom is confided the *matériel* of the telegraphic lines of that kingdom, the use of chloride of zinc has given great satisfaction in the sandy soils of Gelderland; whereas in more calcareous soils, chloride of zinc did not answer the purpose at all, a result also observed in Germany. According to the author, there is a good deal of practical experience yet to be gained in this department of chemical engineering, since every day more and more proves that the nature and qualities of the soil wherein the poles and other timber, railway sleepers, &c., are placed has a vast deal more to do with the preservation of the wood than could be, *à priori*, conjectured.

Annales des Mines, Nos. 3 and 4, 1869.

These two numbers have been issued together, and contain the following original memoirs and papers:—

Mineralogical Tabulated Form.—M. Adam.—This is a concise, but very complete and highly useful, review of the minerals, properly classified in forty-two sections, beginning with hydrogenides, and appendix on meteorites. The table indicates the crystalline forms

hardness, specific gravity, fusibility, and solubility of the various minerals, and contains, moreover, tables of equivalents of the elements and oxidised substances, with the symbols and the quantity of oxygen contained in 100 parts. We, moreover, meet here with a new method for the calculation of the relations of the elementary bodies in any analysis; this may be best explained by quoting the following:—Take, for instance, sulphur, antimony, and silver; the equivalents thereof (O=100) are—S, 200·00; Sb, 1525·00; Ag, 1350·00.

Equivalent of sulphur, $\frac{1,000,000,000}{200} = 50·0000$

" antimony, $\frac{1,000,000,000}{1·325} = 6·5373$

" silver, $\frac{1,000,000,000}{1·350} = 7·4075$

A table being thus made for all elementary bodies, the multiplication by the quotients obtained, of the quantities found by weight as result of the analysis, replaces the division of these same quantities by their equivalents, and yields the same relation; for instance—

Analysis of Miargyrite.

			Rapport, or relation.
Sulphur	21·77 × 50·0000 =	108·850	4
Antimony	41·49 × 6·5373 =	27·206	1
Silver	36·74 × 7·4075 =	27·214	1
	100·00		

The division by the equivalents would have given—

$$\text{Sulphur}, \frac{21·77}{200} = 108·850,$$

and so on for the other elements. This memoir is a most valuable addition to mineralogy, as well as to the chemistry of minerals.

On Smoke-Coloured Quartz.—M. Comminges-Guitaud.—This paper, a letter from the French Minister, resident at Berne, contains full particulars concerning the discovery and the exploration of quartz of rare beauty, accidentally discovered in the Tiefengletscher of the valley of Urseren, Canton Uri, Switzerland. We have before had an opportunity of quoting this subject.

Use of Sewage Water in Agriculture, according to Experiments and Observations made Abroad and in France.—M. Freycinet.—This extensive memoir, filling some 130 pages, is not suitable for abstraction, but deserves the notice of all parties interested in this subject.

Mineral Resources of Algeria.—M. Ville.—This is a complete treatise on the mineral resources of Algeria, treating of the mineral fuel; iron ores; ores of copper, lead, and zinc; ores of antimony and mercury; the metallurgical works; the salt springs, salines, and deposits of rock-salt; deposits of saltpetre; quarries or layers of gypsum and alabaster; lime-stones; building-stones; brick-clay; clay fit for making pottery; slates; pouzzolanes (natural cements); sand fit for industrial use; mineral and thermal springs, divided into four groups, according to their chemical composition; and, lastly, on the success which has attended the boring for water in Algeria. This paper is an excellent monograph, and it would be highly useful if so complete a review of the mineral wealth of every European country were published.

Bibliothèque Universelle et Revue Suisse.—Archives des Sciences Physiques et Naturelles, No. 142, 1869.

This number contains no original papers relating to chemistry or allied sciences.

Moniteur Scientifique, November 1, 1869.

This number contains the following original communications:—

On So-called Iodine Green.—M. Peters.—The author of this paper states that he has thoroughly investigated this subject, and has overcome the difficulties especially attending the dyeing of wool with the green dye, now rather inaptly called iodine green. The author points out that the following advantages are obtained by his method:—(1) Woollen and mixed tissues can be dyed in a short space of time with very pure shades; (2) the colouring material is not wasted, but entirely exhausted; (3) the expense does not exceed that of the use of the so-called aldehyde green, but the iodine green is purer and faster, while shades of green, either verging upon yellow or blue, can be obtained which are not affected by artificial light. The process of dyeing is described as follows:—Impregnation bath (*bain d'impregnation*)—for bluish green, 25 kilos. of liquid iodine green, for dyeing wool, and 75 kilos. of water; for yellowish green, add 22·5 grms. of crystallised picric acid. When this mixture is brought to the boiling heat, there is placed in it a quantity of previously well washed wool which has been treated with sumac. The wool is left in the bath for about half an hour, and, on being removed, the excess of fluid is got rid of by wringing or, better yet, by the centrifugal machine. The liquid thus obtained still contains a sufficient quantity of colouring matter to be used again. The green-producing bath (*bain producteur du vert*) consists of—Water, 100 kilos.; strong sulphuric acid, 250 grms.; liquid bichloride of tin, 125 grms. This bath is used at a more or less elevated temperature, which depends, in great measure, upon the strength and quality of the tissues or yarn to be immersed therein. Instead of the liquid iodine green above alluded to, and which is not well suited for transport, the author states that, of the iodine-green paste, as met with in the trade, 10 parts have to be mixed with 200 of water; the addition of picric acid may be neglected, and, instead thereof, a small quantity of sulphuric or acetic acid should be added. Fifty parts of the fluid so obtained should be mixed with 150 parts of water; ammonia should be added, and the liquid filtered; after which it is only applicable as an impregnation bath, as above alluded to.

Prophylactic Properties of Phenic Acid.—M. Schiffmann.—The author writes from Valle-Menier, Nicaragua, Central America, stating that, after a very severe epidemic of Asiatic cholera, which caused, during fifteen months, the death of a large number of people, he commenced the use of phenic acid (carbolic acid), causing all the rooms and passages of his house and gardens to be daily watered with water to every pailful of which a tumblerful of the aforesaid acid had been added. The same plan was adopted in the cottages and gardens occupied by about three hundred people, with the result that not only no more was heard of the cholera, but there was also a cessation of intermittent fever (ague), which had almost continually pestered that locality. The author adds that he observed the extermination of all vermin, and that he also used the acid in agriculture, in order to kill noxious insects, especially ants, which abound in that clime, and do great injury to cacao trees (*Theobroma cacao*). Mixed with paint, the author applies phenic acid to wood-work, which is thus preserved from the attacks of white ants and similar vermin.

On Soaps and the Chemical Analysis thereof.—M. Joffroy.—Several methods have been at various times proposed for the quantitative estimation of the various constituents of soap. The following methods are quoted here:—50 grms. of the soap are cut up into thin shavings, and dried in a water-bath until no more loss is experienced on subsequent weighing. 12·5 grms. of the soap, cut into thin shavings, are exposed to the action of the air, in order that the free alkali present may thereby become converted into an alkaline carbonate. The sample is next dried, and afterwards dissolved in strong alcohol. In the residue insoluble therein will be found—(*a*) By means of the balance, the total quantity of free alkali (as carbonate) and other salts; (*b*) by means of neutralisation with a test-acid, the quantity of free alkalies; (*c*) by subtracting the quantity of the latter, the quantity of foreign salts will be obtained—that is to say, chlorides, sulphates, &c., of soda, potassa, and other bases. The alcoholic solution is evaporated to the consistency of a syrup, mixed with water, and decomposed by means of hydrochloric acid, whereby the fatty acids are obtained. These, after having been well washed with distilled water, are dried in a water-bath, and weighed. The aqueous solution from which the fatty acids have been separated is evaporated to dryness, ignited, and the residue weighed. This residue is chloride of sodium in the case of hard or soda soap, and, from the quantity obtained, the soda is calculated. In order to estimate the free fat, that is to say, the fat non-combined with an alkali, 10 grms. of the soap are decomposed with hydrochloric acid; the fatty matter is saponified by means of baryta, and the baryta soap obtained is treated with alcohol, whereby the unsaponified fatty matter only is dissolved. The nature of the fatty acids contained in the soap may be ascertained—that is to say, we may find whether stearic, margaric, or oleic acids predominate—by dissolving 5 grms. of the soap in water, adding to the solution enough sulphuric acid to decompose the soap, and the estimating, by means of a very sensitive thermometer, the melting point of the fatty acids; but it should be borne in mind that this operation only gives an approximate result. Another method of testing soap is the following:—Take 1 grm. of the soap, place it in a suitable vessel (a beaker glass), add ether to it, and next acetic acid in a somewhat smaller quantity. The liquid will separate, after a while, into two distinct layers, the upper of which contains in solution the fatty acids, while the lower layer contains the alkalies, and salts, and such substances as might happen to be insoluble in the two fluids just named. By means of a pipette, the fluids are separated from each other. The ethereal solution is poured into a previously weighed beaker glass, and the ether evaporated upon a water-bath, and next again weighed with the fatty acids it contains. The aqueous acetic acid fluid is evaporated to dryness, and the quantity of alkali determined according to well-known methods.

Revue Hebdomadaire de Chimie, November 4, 1869.

This number contains the following original papers:—

Apparatus for Distillation and Concentrating Liquids in Vacuo.—M. Mène.—When a closed vessel filled with steam is suddenly and efficiently cooled, this vapour is condensed, and there is produced inside that vessel a perfect vacuum, saving always the tension of the water vapour at the temperature to which it is cooled down. It is according to this principle that an apparatus has been constructed, which is illustrated by woodcuts, which are essentially necessary to the proper elucidation of the mode of action and arrangement, which is, however, so contrived as to admit of continuous action. The apparatus is made of copper, tinned inside, and is applied with great success to the extraction of the aroma of such plants and parts thereof as cannot, without deterioration of the peculiar fragrancy of the same, be submitted to the ordinary distillation process.

Tubular Germinating Machine for Malt Making.—M. Puvrez-Bourgeois.—The author begins by explaining that preliminary process of beer brewing called malting, which is generally known, although some erroneous opinions are in circulation on this subject. Grain does not, in its healthy and fully ripe state, contain any sugar at all. The process of malting is so conducted that, after the grain has been steeped in water for some hours, and has thereby become quite soft, it is placed on what are technically termed beds, and there kept together in a locality which should not be colder than from 14° to 18°. spread out on these beds, the grain begins to germinate just were sowed in soil, the radicule makes its appearance. It is n

however, to supply to the grain under operation air in sufficient quantity; and, on that account, the grain has to be turned over by means of shovels. The apparatus devised by the author, and illustrated by woodcuts, is constructed with the view of receiving the grain after it has been steeped: it is put in tubes, which are closed by means of perforated lids, and can be moved by means of machinery. According to experience obtained with this apparatus on the large scale, it is highly satisfactory. The author adds one of the most recent analyses of barley, and of malt obtained therefrom. 100 parts, in dry state, contain, for barley—Dextrine, 5·6; starch, 67·0; sugar, 0; cellulose, 9·6; albumenoid substances, 12·1; fatty matter, 2·6; ash, 3·1. For malt—Dextrine, 8·0; starch, 58·1; sugar, 0·5; cellulose, 14·4; albumenoid substances, 13·6; fatty matter, 2·2; ash, 3·2. During the subsequent mashing process, a large proportion of the dextrine is converted into sugar, and the starch into dextrine. The malt here alluded to is the so-called pale, that is, air-dried, malt.

Composition of Different Kinds of Porcelain.—M. Moron.—The materials used for the manufacture of porcelain vary, as will be seen, considerably. At Nymphenburg, Bavaria, the mass is made up of:—Kaolin from Passau, 65 parts; fine white sand, 4 parts; quartz, 21 parts; gypsum, 5 parts; broken-up biscuit, 5 parts. Vienna:—Kaolin from Zedlitz, 34 parts; kaolin from Passau, 25 parts; kaolin from Unghvar, 6 parts; quartz, 14 parts; felspar, 6 parts; metal (broken and ground-up china), 3 parts. Meissen, Saxon-Prussia:—Kaolin from Aue, 18 parts; kaolin from Sosa, 18 parts; kaolin from Seilitz, 36 parts; felspar, 26 parts; metal, 2 parts. The mixture of materials used at Sèvres is only known to those who have the management of that famous manufactory: the kaolin chiefly comes from St. Yrieux.

Pharmaceutische Zeitschrift für Russland, September, 1869.

This number contains the following original papers and communications:—

Monograph on Inuline.—M. Dragendorff.—This lengthy and exhaustive memoir is a compilation embracing everything relating to this subject. The paper is too lengthy to admit of suitable abstraction.

Chloroform, and its Behaviour towards Light and Air.—M. Hager.—The author made a series of researches with commercial chloroform obtained from a firm dealing wholesale in this article. The author's paper is divided into the following sections:—Chloroform of commerce contains, besides real formyl-chloride, other chlorinated compounds, which are not readily separated therefrom.—This is proved by the fact that, after the separation of alcohol and water, which are invariably present in all commercial chloroform, a fluid is obtained which begins to boil at from 60° to 61°, and at the end of the distillation boils at 65°. By repeated fractional distillation, it is possible to obtain pure chloroform, which can only be properly tested for by means of its boiling point and specific gravity. Pure chloroform is not decomposed by the action of light only.—When chloroform is exposed to the direct action of the sun's rays, it becomes decomposed, exhibits an acid reaction to test-paper, and there are found, among its products of decomposition, hydrochloric acid, chloroxycarbonic acid, formic acid, and free chlorine. Chloroform is decomposed when air has access to it, even in the dark, although only slowly.—A quantity of from 0·75 to 1 per cent of alcohol added to chloroform is sufficient to act as a preservative for keeping chloroform for years, even when exposed to daylight. Chloroform, even if it does not exhibit an acid reaction, may be in a state of decomposition.—This decomposition can only be detected by the reaction such chloroform exhibits with ammonia, which then yields with it vapours of chloride of ammonium. The cause and products of this decomposition are not ascertained. The boiling point and specific gravity of chloroform are variously determined by different authors:—The *Pharm. Austriaca*.—Boiling point, 63·5°; sp. gr., 1·49 to 1·5. Dr. Strecker—Boiling point, 61°. M. Limpricht—Boiling point, 62°. M. Biltz—Boiling point, 62·05°. Specific gravity—At 10·2°=1·5085; at 15°=1·5020; at 17·75°=1·4971; at 20·0=1·4936.

Action of Iodine upon Arseniuretted and Antimoniuretted Hydrogen.—Dr. Husson.—The author finds that both these gases, when made to pass over iodine, readily yield iodides of arsenic and antimony. The author further suggests that this reaction should be made use of in toxicological investigations. For this purpose, when Marsh's apparatus is used, a small quantity of iodine should be placed in that portion of the tube where, commonly, the metallic mirror is made apparent; that part of the tube is gently warmed, so that the iodine coats the tube; and the gas is then made to pass, care being taken to keep the tube somewhat warm. Should the gas contain arsenic, a yellow-coloured mirror will be at once observed; when the gas contains antimony, an orange-coloured iodide of that metal is formed. The iodide of arsenic yields, when volatilised, yellow-coloured vapours, while the vapours of iodide of antimony are of a deep red hue.

Les Mondes, November 4, 1869.

We learn from this journal that M. Wurtz, the well-known scientific chemist, and Dean of the Medical Faculty of Paris, has been nominated Commander of the Order of the Legion of Honour. Among the number of scientific men who have been decorated as chevaliers of the same order, we meet with the names of MM. Schutzenberger, Friedel, and other well-known scientific men.

Navigation on Canals.—M. Bouquié.—Although this short notice does not exactly belong to the sciences usually treated of in our pages, we cannot refrain from quoting the following curiosity:—The distance from Mons (Belgium) to Paris, by canal, is 350 kilometres. The distance from Cardiff to Singapore is 25,000 kilometres; yet the journeys from Mons to Paris are performed by canal so slowly, that the journey from Cardiff to Singapore, if performed at the same rate of speed, would occupy eleven years. The coal-laden barges sailing between Mons and Paris make only three journeys during a whole year.

Manufacture of Manganate of Lime.—M. Delaurier.—Manganate of lime, CaO,MnO_3, can be directly obtained by heating together any oxide of manganese, previously reduced to powder, and mixed with slaked lime or chalk in equivalent proportions. The two substances should be intimately mixed, and heated to redness, with contact of air and constant stirring of the mixture, in order to promote the absorption of oxygen. This compound is insoluble in water; it is far more readily prepared than the manganates of soda and potassa, because these are fusible, and, hence, less manageable during the process. The manganate of lime yields oxygen on being heated by itself; and, when treated with sufficient sulphuric acid to convert the lime and manganese into sulphates, two equivalents of oxygen are given off. The waste manganese salts obtained in various manufacturing processes may be usefully applied to the preparation of the manganate of lime.

Apparatus for the Demonstration of the Fall of Bodies.—M. l'Abbé Vassart.

Boiling Point of Water at Localities the Height of which Above Sea Level has been Correctly Determined.—M. Ziurek.—The heights are expressed in metres, the average reading of the barometer at each locality in millimetres, the boiling point in °C. The highest inhabited spot on the globe is the township of Antisana, Peru (4101 metres above sea level)—Barometer, 454; boiling point, 85·3°. City of Quito (2908 metres)—Barom., 527; b.p., 90·1°. Santa Fé de Bogota (2661 metres)—Barom., 5·44; b.p., 90·9°. City of Mexico (2270 metres)—Barom., 5·72; b:p., 92·3°. Hospice du St. Gothard, Switzerland, the highest inhabited locality in Europe (2075 metres)—Barom., 586; b.p., 92·9°. Gavarni, France (1444 metres)—Barom., 634; b.p., 95·0°. St. Ildefonse Palace, Spain (1155 metres)—Barom., 657; b.p., 96·0°. Madrid (608 metres)—Barom., 704; b.p., 97·8°. Munich, Bavaria (538 metres)—Barom., 710; b.p., 98·1°. Moscow (300 metres)—Barom., 732; b.p., 99·0°. Rome (46 metres)—Barom., 756; b.p., 99·8°. Berlin (40 metres)—Barom., 756; b.p., 99·8°. As regards London, the enormous size of this province of houses makes it impossible to define, for that great extent, any average. Those portions nearest to the river are no more than about from 3 to 5 metres above sea level (not to be mistaken for what is locally known as Trinity high-water mark), while the more elevated portions are some 30 to 40 metres above the same level.

NOTES AND QUERIES.

By-Products Containing Soluble Phosphates.—Will any of your correspondents give information as to where any by-products can be obtained containing 3 per cent and over of soluble phosphate?—Arthur Warner.

Preventing Moisture in Glass Cases.—Wishing to enclose a philosophical instrument in a second outer case of glass, where moisture is an enemy, can any correspondent inform me which is the best material to use, chloride of calcium, quicklime, $HO+SO_3$, dehydrated alcohol, or a small stick of sodium (to be scraped occasionally)?—S. E. P.

Standard Verification.—Having to deal with 1-1000ths of an inch, and having a friend who has to deal with 1-10,000ths of an inch, and finding a deplorable ignorance among the skilled artisans of London and an awful discrepancy with expensive gauges by Holtzaffel's, Elliott, and others, can any correspondent guide me to any system of standard verification? Outside the Greenwich observatory may be seen a standard of feet, inches, and moderate subdivisions. Is there any inner department for finer minutiæ available for the public?—S. E. P.

MEETINGS FOR THE WEEK.

Thursday, 18th.—Chemical, 8. Prof. Church, "On Namaqualite," and "Chemical Researches on New and Rare Cornish Minerals (No. 6)—A New Ferric Silicate." Dr. Stenhouse, "On Chloranil and Bromanil (No. 2)"

TO CORRESPONDENTS.

J. and E. Sturge.—Apply to Asher and Co., Foreign Booksellers, Bedford Street, Covent Garden.

E. U.—Comptes Rendus is published by Gauthier-Villars, Quai des Augustins 55, Paris.

J. Miller.—"Ancient and Modern Industry of the Chinese Empire" is published by Eugène Lacroix, Paris.

An Old Subscriber.—Reimann's "Handbook of Aniline," price 10s. 10d., post free, from our office.

Metallurgist.—You had better advertise in our columns for the situation you require.

W. U.—Mitchell's "Assaying" will answer your purpose best.

THE CHEMICAL NEWS.

Vol. XX. No. 521.

FLUX FOR BLOWPIPE ANALYSIS.

By Professor HOW, D.C.L., Windsor, Nova Scotia.

Under the heading given above, the Chemical News last year (vol. xviii., p. 203) reprinted a note by Mr. S. D. Poole to the *Scientific American* on the advantages of a mixture of selenite and fluor over the well-known flux of bisulphate of potassium and fluor devised by Turner as a reagent for producing coloured flames before the blowpipe, and over selenite alone as an addition to silicates, recommended by Fresenius. Mr. Poole's objection to the former is the intense violet tint given to the flame by potassium, and to the latter, its infusibility and want of decomposing power. This reagent, he says, "forms an easily fusible bead, which by itself gives only a very faint dull red tint (lime) to the flame, but which renders the presence of such elements as give colour most beautifully evident and characteristic."

My present object is to point out that the newly proposed flux is of more limited applicability than that of Turner, because there is no provision in it for the liberation of hydrofluoric acid. In testing for boracic acid *e.g.*, it fails completely to give the green flame with natroboro-calcite and with borax, whereas Turner's flux gives a distinct reaction in each case. When silica is present in minerals along with much boracic acid, the addition of either of these fluxes is superfluous; thus with silico-boro-calcite a fine green—not yellowish green—is obtained with the mineral alone. Sussexite gives a yellowish green colour alone, and the addition of Poole's flux seems to me to obscure the reaction, while Turner's gives a fine green flame. As regards some other colouring elements, when colour is given by minerals alone, the best colour is obtained without the new flux; this is the case with celestine and strontianite. When silica is present, the test answers well in some instances, as with lepidolite and spodumene, and especially, as Mr. Poole states, with the felspars in which K and Na exist alone or predominate respectively. I may mention that small quantities of boracic acid which escape detection by using even Turner's flux, may be discovered in minerals soluble in HCl by repeated wetting and drying of the turmeric paper.

SUPERSATURATION, SURFUSION, AND SOLUTION.

By M. DUBRUNFAUT.

Supersaturation is evidently a badly-defined phenomenon of solution; and a study of these phenomena is the only way of ascertaining the cause of supersaturation.

The interesting labours of M. Gernez, animated by the beautiful experiments of M. Pasteur, have established, in the most complete manner, the active part invariably played by the crystal which causes a cessation of the state of supersaturation in similar or isomorphous crystals. This proves the existence of a special power in the crystals themselves, varying in its mode of being according to their chemical and geometrical formation. But the labours of M. Gernez end here; they show, in fact, in the case of sulphate of soda, for instance, the generalisation of the long-known property possessed by a crystal of sulphate of soda of causing a supersaturated solution of the same salt to instantly assume the form of a crystalline mass. Nothing, however, of the cause of this fact, or of its relation with the condition of supersaturation, has been explained.

M. Loewel has fully proved, with regard to the supersaturation of sulphate of soda,* that the salt dissolved as the compound $SO_3NaO.10HO$ is found in solution in the state of $SO_3NaO.7HO$. The experimental demonstration of this fact appears to be the result of the exact analysis of crystals formed simply by lowering the temperature of the supersaturated liquid. The dissolved salt which is thus brought into a state of supersaturation changes its nature, or, at least, its molecular constitution. It now becomes a totally different product, possessing other properties, and that which is considered as supersaturation of the primitive product is really, in the new substance derived from it, merely a normal saturation; in other words, sulphate of soda is dissolved in water in the proportion of 10 equivalents of the latter, and, upon overcharging the solution with an excess of the salt, its composition is modified in such a manner as to create a new and more soluble product, consequently susceptible of producing that apparently strange phenomenon called supersaturation.

This interpretation of the facts relating to supersaturation does not detract the rules of the experimental method; and, by developing its logical consequences, the theory may be generalised and applied to all cases of solution, even to those not possessing the characteristic properties of supersaturation.

If it be certain (as we admit) that the sulphate of soda, with 10 equivalents of water, exists in the so-called supersaturated solution, with the molecular composition characterised by 7 equivalents HO, it is none the less true that, under certain known conditions, the composition of the salt may return to its primitive condition, which clearly proves, in the dissolved sulphate of soda, an unstable and fugitive molecular condition, which any accident or untoward circumstance may alter or destroy. This is what happens, in fact, under the influence of a crystal similar to sulphate of soda with 10 equivalents of water, or of an isomorphous salt; and, in this case, the return of the salt to its primitive composition is accompanied by a thermic manifestation, which confirms the change, such as may be noticed in amorphous allotropic changes, and in those of substances which crystallise in two shapes.

The modifications which matter presents in solution are confirmed, under another form, by the fact of double molecular rotation, which has been observed in crystalisable glucose, lactine, and their derivatives. In these cases, the crystallisable substances evidently contract the molecular constitution which they display at the moment of solution from the power of crystallisation, and it lasts sufficiently long to be quite perceptible. In the case of crystallised glucose, the transition of bi-rotatory to the state of mono-rotatory glucose requires, at a low temperature, four or five hours for completion.

This property is not perceptible in all molecularly-active substances, but it is believed to be general and proper, not only to all substances possessing the molecular property, but to all soluble substances whatsoever.

It is, therefore, highly probable that all soluble, crystallisable, or amorphous bodies have, when in solution, a different molecular constitution to that possessed by them when in a solid condition. This modification, as is proved by supersaturation and double rotation of glucose, is only ephemeral, and depends upon the particular condition of the substance in solution, and perhaps, also, on the nature of the solvents; it ceases when the causes which produce it are removed.

* M. Gernez, who has studied this subject with care, attributes the priority of the observations in question to foreign observers; but M. Loewel has also worked them out in a much better manner, without having previously heard of them, and therefore deserves the credit of an original discovery.

Thus it is retained by crystallised glucose in its crystalline state, whether its constitution be $C_{12}H_{12}O_{12}$ or $C_{12}H_{14}O_{14}$; but the moment that the crystal becomes liquefied, either by melting or by any kind of solvent, its molecular constitution, displayed by its rotatory power, is changed, and can only be regained by a return to the solid condition. Thus all known facts relating to supersaturation and surfusion may be explained without the necessity of distinguishing these different conditions of matter by the physical causes which annul them.

Solution, regarded thus, enters into the category of known chemical forces, which modify, in a regular and invariable manner, the arrangement of elements in integrant molecules.

After a careful examination of osmotic analysis as applied to complex saline solutions, I find that it is impossible to agree that diffusibility, which is, as we have demonstrated, the vehicle of this mode of analysis, occurs when the substance in question is in a solid state; on the contrary, everything goes to prove that the elements of the current of exosmose which produce the analysis are derived from a fraction of the solvent charged with the diffusible product. If this were not so, it would be difficult to account for what passes in my methodical analysis of molasses, in which the diffusion of sugar is constant at every period of the analysis, whilst the diffusion decreases geometrically in proportion as the analysis reaches its termination.

It certainly must be admitted that, in a solution of sundry salts, possessing different physical and chemical properties, each salt takes and retains, even in the complex solution itself, that contingent of the solvent assigned to it by its special qualities. It is upon these molecular liquid groups, which are more or less defined in every medium, that the force of diffusion is exercised which acts in so evident a manner in all cases of endosmotic analysis.

Here is another important fact in molecular physics which has been confounded by experimentalists with those of supersaturation.

When a crystallisable substance, such as sugar, is extracted from its solution in water by very strong alcohol, two different cases may arise, according to the conditions of the experiment, in which the sugar remains for a moment in a state resembling the phenomenon known as supersaturation, but which really differs from it essentially, or the sugar is precipitated in viscous lumps resembling precipitates formed under the same conditions by gum, dextrine, &c.

Upon examining this precipitate with a microscope, an amorphous or globular texture is easily observed, and these products float in the alcoholic solution. After a certain time, the viscous precipitate is transformed into well-defined prismatic crystals of sugar. These facts appear frequently, if not always, under the experimental conditions specified by M. Margueritte—to separate sugar from molasses by means of alcohol and sulphuric acid. This effect has been confounded with the known phenomenon of supersaturation. Under these conditions, alcoholic solutions said to be exclusively supersaturated furnish their contingent of sugar without change of density, which proves that all the sugar obtained was the result of amorphous sugar. Is not this transitory state of the sugar shown by the action of the alcohol on the dissolved sugar, the normal condition of sugar modified by solution? and is not this experiment a fresh proof in support of my mode of considering the phenomena of solution and supersaturation?

Is not that particular state of matter to which Mr. Graham has given the name of *the colloid condition*, a transitory and ephemeral condition analogous to that to which I have just called attention with regard to crystallisable sugar, and which is common to a number of other substances soluble and crystallisable from alcohol?—*Comptes Rendus.*

MODIFICATION OF THE METHODS FOR THE

VOLUMETRICAL ESTIMATION

OF THE

QUANTITY OF COPPER AND ZINC CONTAINED IN ORES

BY MEANS OF A STANDARD SOLUTION OF FERROCYANIDE OF POTASSIUM.

By M. MAURIZIO GALBTTI,
Chief Assayer and Chemist of the Royal Assay Office at Genoa.

When the ores of copper or zinc, after having been acted upon by acids, are treated with excess of ammonia in order to precipitate the oxide of iron, that substance invariably retains larger or smaller quantities of the oxides of the metals just named. The quantity thereof so retained varies according to the larger or smaller quantity of copper and zinc contained in the ores. It is hence necessary to repeat the treatment with ammonia at least twice, sometimes even three and four times, in order to obtain a complete separation of copper or zinc from the iron.

In order to obviate the loss of time which is caused by these operations, the author proposes to convert into acetates the small quantities of the oxides of copper and zinc which accompany the precipitate of oxide of iron. This can effected by two different methods, dependent on the fact whether the oxide of iron is removed by filtration (previous to the use of standard solution of ferrocyanide of potassium), or is left in the ammoniacal liquid. The operation is conducted as follows.

Suppose a copper pyrites to be submitted to analysis. Take 1 grm. of the previously very carefully pulverised and dried ore. Treat it first with concentrated nitric acid, boiling to incipient dryness, in order thereby to free the sulphur from any small particles of ore which at are first taken up by it. Add 10 c.c. of hydrochloric acid, boil down to about half that bulk, dilute with distilled water, and next add ammonia in large excess; boil the fluid, and next add pure acetic acid (sp. gr., 1·070) until the liquid assumes an emerald-green colour. After the liquid has been well stirred up, boil again for about two minutes; then add again ammonia in excess. The liquid is then poured out of the flask into a suitable glass vessel, and the flask is rinsed out with a sufficient quantity of distilled water to bring the bulk of the fluid up to ½ litre. This having been done, the fluid is very cautiously and gradually acidified with very dilute acetic acid, 1 part of the acid just alluded to, and 10 parts of distilled water. Any large excess of this acid should be avoided; the fluid should only be very slightly acid. As soon as the basic acetate of iron has subsided, the precipitation of the copper by means of the standard solution of ferrocyanide of potassium is proceeded with.

Since the oxide of copper which might have adhered to the oxide of iron has been converted by the process just described into a soluble salt, it cannot fail to be completely precipitated by the ferrocyanide of potassium solution. When a determination of copper has to be made in ores which are rather poor (that is to say, contain less than, or up to, 6 per cent of copper), it is preferable to add to the nitric acid solution 0·1 grm. of pure copper, which quantity has to be deducted afterwards from the results obtained. This precaution is required in order to prevent the presence of a large quantity of oxide of iron from vitiating the results of analysis of poor ores. When ores contain up to 12 per cent of copper, a quantity of 1 grm. of the ore should be taken; but, for richer ores, 0·5 grm. is sufficient. It is always advisable to make a control analysis with pure copper at the same time while testing the ores.

The second modification is carried out in the following manner.

After the second addition of ammonia to the liquid, it is filtered, and the precipitate is washed with a dilute and

boiling solution of acid acetate of ammonia. This solution is prepared by saturating 20 grms. of pure acetic acid with ammonia, and addition thereto of 15 grms. of pure acetic acid in 585 grms. of water. When the washing of the oxide of iron is carefully done, the salt of copper, which tenaciously adheres to the oxide of iron, is entirely removed therefrom; but it will require about 400 grms. of the fluid, the preparation of which has just been described.

The normal solution of copper should be treated as follows.

A quantity of 0·2 grm. of pure copper is dissolved in nitric acid; excess of ammonia is added; the fluid next acidified with acetic acid, thereupon diluted with 400 grms. of acid acetate of ammonia, and the whole brought up to 500 grms. To this solution 20 c.c. of the standard solution of ferrocyanide of potassium are added, and, after the necessary corrections have been made, the liquid must not contain any more excess of either copper or of ferrocyanide.

The standard solution of ferrocyanide of potassium to be used for the determination of copper is made by dissolving 50·225 grms. of ferrocyanide in as much distilled water as will suffice to make the solution weigh exactly 1 kilogramme.

The ferrocyanide solution destined for the estimation of zinc is made by dissolving 41·250 grms. of the said salt in the same quantity of water.

If it should happen that the copper ores contain zinc, nickel, and cobalt, the copper should be first separated from these metals, either by precipitating the copper from its solution in acid by means of zinc, or as sulphide of copper by means of hyposulphite of soda.

Zinc ores are treated in the very same manner as just described for copper ores. When sulphuret of zinc (the "black-jack" of English miners) is to be operated upon, care should be taken that, after the addition of hydrochloric acid, the fluid should be sufficiently far evaporated as to insure the expulsion of all nitric acid. Since zinc ores are usually rather rich, ½ grm. is sufficient for analysis. Calamine-stone (native carbonate of zinc) should at once be acted upon with hydrochloric acid; but, in order to make sure of the complete oxidation of all the iron the ore may happen to contain, it is best to add to the acid a few decigrammes of pure chlorate of potassa. After having suffered this solution to boil for a few minutes, it is diluted with distilled water; a large excess of ammonia is added to the solution, and it is next treated as above-described for copper.

The author states that he has convinced himself, by a set of experiments instituted on purpose, that the presence of compounds of lead (as, for instance, carbonate, sulphate, and sulphide of lead) occurring along with the ores of zinc, does not interfere with the correctness of the complete precipitation of zinc as ferrocyanide of zinc. This even holds good up to 10 per cent of metallic lead, a quantity which does not, also, interfere when mixed with copper ores.

Since some ores of zinc, especially calamine-stone, may, and often do, contain manganese, it is best to add to the ammoniacal solution, before any acetic acid is added, a few drops (from 2 to 4) of bromine, in order to convert thereby the protoxide of manganese into protosesquioxide, leaving the solution standing for twenty-four hours after the addition of the bromine.

Since the ammoniacal solution of chloride of zinc is colourless, there should be added to it, previous to the very cautious acidification by means of dilute acetic acid, a few drops of tincture of litmus, in order to more readily hit the precise point of sufficient acidification, to be exhibited by the blue colouration changing to a rose-red.

When iron is present, the same precautions are to be observed as described under copper.

The ferrocyanide of zinc which is mixed with oxide of iron preserves its naturally-white colour as long as the liquid yet contains free zinc, but its colour changes to a greyish white as soon as a very slight excess of the ferrocyanide standard solution is present; the liquid then also becomes turbid, and the precipitate settles very slowly. By these constantly-occurring and quite characteristic signs, the end of the operation may be always recognised. In order to make sure, the liquid should be stirred up with a glass rod which has been just previously moistened with an acidified and dilute solution of ammoniacal nitrate of copper, which will have the effect of indicating any excess of the ferrocyanide solution, by exhibiting the more or less intense colour characteristic of ferrocyanide of copper. The zinc solution should be at a temperature of from 40° to 50°, whereby the rapid precipitation and subsidence of the ferrocyanide of zinc is promoted.

When filtration is avoided, the presence of the gelatinous silica (due to the decomposition of silicates of zinc occurring in the ores of that metal, and brought to a gelatinous condition by the treatment of such ores with hydrochloric acid) does not interfere with the correctness and good results of this method of estimating zinc quantitatively in its ores.

It is gratifying to learn that, since the discovery of extensive and very valuable zinc ore deposits (calamine-stone) in the island of Sardinia, and the demand for this ore created in England, France, Belgium, and Rhenish Prussia, a committee of analytical chemists from these countries have, after having previously made themselves fully acquainted with the method of analysis of zinc ores just described, unanimously resolved to estimate the zinc (to be brought under contract to each of the countries just named from Sardinia) by the method here described, as being the best suited for the purpose.—*Zeitschrift für Analytische Chemie.*

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 233.)

Many other saline solutions will be found in microscopical works. The best have been given above; a larger selection would tend rather to confuse than assist the beginner.

Glycerine is one of the most valuable materials ever added to the resources of the microscopist. We are indebted to the late Mr. Robert Warington for the application of this fluid to microscopical purposes. It is obtained as a waste product in the manufacture of soap, and lead plaster. The quality of the glycerine from these sources is very inferior, being both weak and impure. The best is that made by Price's Patent Candle Company, and obtained by a distillation process. This is much purer and stronger than the common kind, having a specific gravity of about 1240, and is the only kind fit for use by the microscopist. The properties of glycerine as a means of giving transparency to an object have already been mentioned. It is a thick, syrupy, and highly refractive fluid, nearly colourless, and intensely but pleasantly sweet. Although made from fat, it is not at all greasy, but freely miscible with water and many other fluids; it is also a solvent for a great number of substances. Its action upon varnish has already been alluded to. It is stated by Dr. Carpenter that it dissolves carbonate of lime readily, and quite destroyed the calcareous skeleton of certain *Echinodermata* mounted in it. He suggests that, when used for such purposes, it should be saturated with carbonate of lime

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

by being kept in a bottle with some fragments of marble ("Microscope and its Revelations," fourth edition, p. 222). One of the advantages of glycerine is that it never dries; so that an object can be placed in it, covered with a glass, and left uncemented, without fear of evaporation for any length of time, and afterwards mounted permanently, if desired. Owing to its free miscibility with other substances, it forms many very valuable compounds, some of which will presently be described. A very full account of its use in delicate physiological investigations is given in Dr. Beale's "How to Work with the Microscope," a book of the greatest service to all intending to study the particular subjects upon which it treats. It is by the use of glycerine that Dr. Beale has succeeded in carrying on his elaborate investigations of the ultimate structure of nerve tissue under excessively high powers; and his processes afford a remarkable illustration of the support afforded to a delicate tissue by immersion in a fluid of extreme density, the manipulation of tender substances being comparatively easy in glycerine, when, in water or alcohol, it would have been impossible.

Strong glycerine preserves nearly every kind of object, whether animal or vegetable, with great perfection, and is, perhaps, the nearest approach to an universal mounting-fluid yet known. Insects and other objects may be put into a bottle of glycerine, and left until wanted; they are even better after a year or two's soaking. Objects mounted in glycerine generally improve after a time, details often being visible which were not seen immediately after mounting. The introduction of the binocular microscope has very much influenced the style of mounting objects to be viewed with low and medium powers. For this purpose, it will be found advantageous to mount the object with little or no compression. Of course, for examination with high powers, thin and compressed specimens are absolutely necessary (see author's paper, *Monthly Microscopical Journal*, vol. i., p. 331).

Glycerine can be diluted to any extent, either with camphor or creosote water, should it be desired to obtain a less refractive fluid, and one which does not render objects so transparent as pure glycerine; sometimes a portion of alcohol may be added with advantage. This compounding of media is one of the greatest arts in fluid mounting, and can only be acquired by experience, as, at present, no definite directions can be given. Diluted fluids, as a general rule, make animal tissues more granulous and opaque after a time than the strong, dense ones. The author possesses an instance of a difficult mounting accomplished almost by chance. The subject was the Medusoid embryo of *Hydra tuba*, which he had been observing at a friend's house. Thinking it a pity to lose a specimen then seen for the first time, he took the object home alive in its cell of sea-water, and then determined to attempt its permanent preservation. The course of operation was as follows:—The slide was placed in a saucer, which was quickly filled with strong alcohol (about 60 over proof). This fortunately killed the animal so suddenly that it was but little contracted. A mounting-fluid, consisting of glycerine, alcohol, and sea-water, was then extemporised, and the object mounted. It is still in good preservation, although somewhat opaque. It was mounted in February, 1862. This is given as an instance of the kind of practice occasionally needed in cases of emergency, and where the tact acquired by experience may be turned to good account.

It is occasionally convenient to make use of a medium which, while it is fluid at the time the object is mounted, will ultimately harden, and preserve the object from injury from being shaken or moved. Such media are especially useful for mounting *Diatomaceæ* attached to other *Algæ*. There are many compounds of this nature, some of the best of which are largely composed of glycerine.

The earliest of these was that known as *Deane's gelatine*. It is composed of—Gelatine, 1 oz.; water, 4 ozs.; honey, 5 ozs.; creosote, 6 drops; alcohol, ½ oz. The gelatine is to be soaked in the water until quite soft; the honey, heated to the boiling point, is to be added. The whole is then to be boiled, and, when it has cooled a little, the creosote and alcohol, mixed together, are to be added, and the whole filtered through fine flannel.

Glycerine jelly consists of gelatine soaked in camphor-water until it swells and becomes soft. The surplus water is to be poured off, and the jelly strained, and, if necessary, clarified after the manner of confectioners with white of egg. To every ounce by measure of this jelly add 1 drachm of alcohol and 6 drachms of Price's glycerine.

Both these media are used by melting the composition by placing the bottle in hot water, just as glue is melted. It is then used almost precisely in the same way as Canada balsam, taking the precaution to prepare the object by a previous soaking. Thin objects do not require a cell. When the gelatine has hardened sufficiently, the surplus portion is scraped off, and the slide cleaned. It should then be secured with a coat or two of liquid-glue, followed by several coats of gold-size, as in moist preparations.

A very useful medium of nearly similar properties is made according to the following formula of Mr. Farrants:—Picked gum arabic, 4 parts by weight; water, 4 parts; glycerine, 2 parts. The mixture is to be made cold, and, if necessary, strained through fine muslin. It is to be used in the same manner as the foregoing gelatinous preparations, only without heat, which renders it particularly fit for objects that will not bear the slight increase of temperature required to liquefy gelatine.

The action of all the above media is nearly similar to that of slightly diluted glycerine, excepting that, when set, they keep the object fixed in the position in which it was mounted.

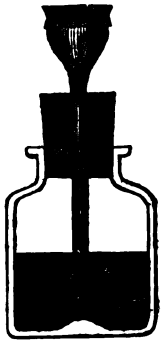
Strong syrup is capable of preserving animal and vegetable tissues, but is, under some conditions, liable to crystallise. The best proof of the perfect manner in which vegetable substances are preserved is given in the condition of preserved fruits, which are in an extremely favourable condition for microscopical examination. The samples of jam, &c., examined by Dr. Hassall, and reported upon in his "Food and its Adulterations," were probably among the tissues most easily identified, owing to their perfect condition.

Castor-oil will be found an excellent mounting-fluid; it penetrates, and gives considerable transparency, and keeps the object well and for a long period. It is particularly successful with parasitic insects; these may be placed in a bottle of castor-oil, and kept until required for mounting. As castor-oil is so readily procured, being in every medicine-chest, and to be obtained at any little village shop, it is a very useful medium for those who may wish to pre-

serve insects, &c., captured while travelling, as they need no attention after they are immersed in it. Should it be desired to mount the objects ultimately in some other medium, the oil can easily be removed by soaking in benzol.

Mounting-fluids which are in frequent use are best kept in a small, wide-mouthed bottle, through the cork of which is passed a pipette, surmounted by a funnel at its upper extremity, upon which is stretched a piece of sheet india-rubber (Fig. 18). By this

Fig. 18.



contrivance, a small quantity of fluid can be taken up, and delivered, drop by drop, upon the slide. Where mounting-fluids are continually required, as in pathological laboratories, Dr. Beale has contrived a little fountain on the principle of the wash-bottle, which answers admirably for a supply of any kind of fluid in drops; but, for the occasional use of the student, the pipette-bottle is to be preferred.

Closely connected with fluid mounting is the process of staining tissues. This is used for two widely different purposes. The first for rendering very transparent bodies more easily visible; this is easily done by immersion in magenta, diluted as the particular case may require. The other for more clearly defining certain parts, or parts in a particular state; this is done by using staining fluids which act unequally. For instance, if it be desired to stain the nuclei of cells, the following solution of carmine, described by Dr. Beale in "How to Work with the Microscope," and reprinted here by his kind permission, will answer admirably:—"Carmine, 10 grains; strong liquor ammoniæ, ½ drachm; Price's glycerine, 2 ozs.; distilled water, 2 ozs.; alcohol, ½ oz. The carmine, in small fragments, is to be placed in a test-tube, and the ammonia added to it. By agitation, and with the aid of the heat of a spirit lamp, the carmine is soon dissolved. The ammoniacal solution is to be boiled for a few seconds, and then allowed to cool. After the lapse of an hour, much of the excess of ammonia will have escaped. The glycerine and water may then be added, and the whole passed through a filter or allowed to stand for some time, and the perfectly clear supernatant fluid poured off and kept for use. This solution will keep for months, but sometimes a little carmine is deposited, owing to the escape of ammonia, in which case one or two drops of liquor ammoniæ to four ounces of solution may be added." For further information relative to the application of the staining process, and the observations to be carried out by its means, the student is referred to Dr. Beale's work.

Solutions of chloride of gold and nitrate of silver may also be employed to advantage (see paper by Dr. Bastian before quoted; T. Dwight, *Monthly Microscopical Journal*, vol. ii., p. 45).

(To be continued).

ON A NEW CHROMIUM OXYCHLORIDE.*

By T. E. THORPE, Ph.D.,
Assistant in the Laboratory of Owen's College.

When chromyl dichloride $CrO_2\left\{\begin{matrix}Cl.\\Cl.\end{matrix}\right.$ prepared by heating a mixture of potassium dichromate, sodium chloride, and sulphuric acid, is maintained at a temperature of 180° C. —190° C. in a sealed tube for three or four hours, it is almost completely converted into a black solid substance, and on opening the tube when cold a considerable quantity of free chlorine escapes. By exhausting the tubes containing the liquid chloride before subjecting them to heat, I have ascertained that chlorine is the only gaseous product of this decomposition. The black compound invariably contains more or less of the liquid chlorine which has escaped decomposition: the greater part of this is easily expelled on gently heating the mass after opening the tube. In order to free it completely from the latter body, the black substance was transferred to a clean tube and heated to 120° C. (*i.e.*, about 2° above the boiling point of chromyl dichloride) in a current of dry carbonic acid gas until its weight appeared constant. The following determination of the amount of chlorine contained in the volatile portion shows that it is simply chromyl dichloride which has remained undecomposed.

0·8741 grm. liquid chloride gave 1·6458 grms. silver chloride.

Calculated for CrO_2Cl_2.	Found.
45·7 per cent.	46·5 per cent.

The solid substance dried in the manner above described appears as a black uncrystalline powder, which when exposed to the air rapidly deliquesces to a dark reddish brown syrupy liquid which smells of free chlorine. When thrown into water it quickly dissolves, forming a dark brown solution, which on standing also evolves chlorine. In nitric acid solution hypochlorous acid appears to be produced. In strong hydrochloric acid the substance dissolves with a dark brown colouration, and on boiling the solution, chlorine is evolved, the liquid becomes greenish yellow, and ultimately changes to the dark green colour peculiar to a solution of chromium sesquioxide in hydrochloric acid. When thrown into dilute ammonia, chromic acid is dissolved, together with all the chlorine, and a precipitate is formed possessing the properties of the chromate of chrome sesquioxide ($Cr_2O_3CrO_3$) described by Storer and Eliot. Upon this decompostion is based the method which I have employed for the estimation of the amount of chlorine contained in this body. The weighed quantity of the substance was treated with very dilute ammonia, the solution boiled for a few minutes, filtered, the precipitate well washed by hot water, an excess of nitric acid added to the filtrate, and the chlorine precipitated by the addition of silver nitrate. Two determinations of chlorine carried out in this manner on preparations made at different times gave the following results:—

Preparation I.

0·5900 grm. substance gave 0·4870 grm. silver chloride and 0·0069 grm. metallic silver.

Preparation II.

0·493 grm. substance gave 0·4250 grm. silver chloride,

Prep. I.	..	20·80 per cent Cl.
Prep. II.	..	21·32 „ „
Mean	..	21·06

* Read before the Manchester Literary and Philosophical Society, November 2, 1869.

In order to determine the amount of chromium it contains a weighed portion of the substance was repeatedly heated with strong hydrochloric acid on a water-bath until the evolution of chlorine entirely ceased; the solution was then diluted with water, heated to boiling, ammonia added in slight excess, and again boiled until the supernatant liquid appeared perfectly colourless. The precipitated chrome sesquioxide was then filtered, dried, and weighed.

Preparation I.

0·3442 grm. substance gave 0·2470 grm. chrome sesquioxide.

0·5900 grm. substance gave 0·4235 grm. chrome sesquioxide.

Preparation II.

0·5082 grm. substance gave 0·3590 grm. chrome sesquioxide.

0·5942 grm. substance gave 0·4210 grm. chrome sesquioxide.

Prep. I.	49·30	per cent Cr.
	49·25	,, ,,
Prep. II.	48·45	,, ,,
	48·62	,, ,,
Mean	48·91	

Hence the percentage composition of the substance is as follows:—

	Found.	Ratios.	Calculated.
Chlorine	21·06	2	21·86
Chromium	48·91	3	48·54
Oxygen	30·03	6	29·60
	100·00		100·00

I have attempted to control the above empirical formula ($Cr_3O_6Cl_2$) by heating a weighed portion of the substance in hydrogen. The action of hydrogen upon the new chloride when heated is extremely energetic. At a comparatively low temperature it takes fire, combustion proceeds rapidly throughout the mass, and ultimately the substance is converted into chrome sesquioxide, hydrochloric acid, and water. Care must be taken to regulate the current of the hydrogen, since, if too rapid, particles of the finely divided sesquioxide are apt to be mechanically carried away. From an experiment, in which the gas was carefully purified from oxygen by passing it through strongly alkaline pyrogallate solution and over heated metallic copper, and then dried by transmitting it through tubes containing pumice moistened with strong sulphuric acid, the following numbers were obtained:—

0·8715 grm. substance gave 0·6150 grm. chrome sesquioxide.

Found 70·58 per cent Cr_2O_3.

$Cr_3O_6Cl_2$ gives by calculation 70·72 per cent.

I had an additional object in thus studying the action of hydrogen upon the new chloride. I considered that this action might, possibly, throw some light on the constitution of this compound. The new oxychloride may, in conformity with the analytical results, be regarded as a compound of chromous chloride with two equivalents of chromium trioxide. Now, chromous chloride, according to Moberg, may be heated in hydrogen to the softening point of glass without suffering decomposition, and if it were found that water was the only volatile product of the reaction, we should possess a certain amount of evidence for supposing that the formula $CrCl_2,2CrO_3$ represents the constitution of this substance. Experiment showed, however, that the chlorine was not so firmly united in this compound as in the chromous chloride: on gently heating the substance in hydrogen, hydrochloric acid was immediately evolved.

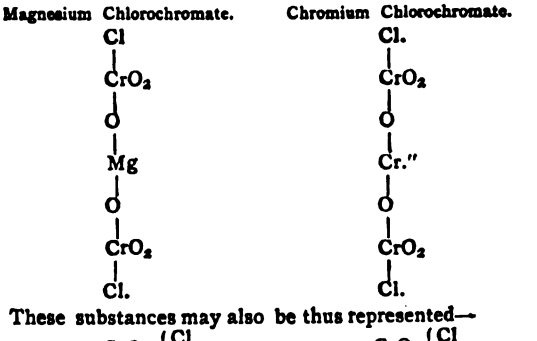
Péligot has described a series of salts to which are assigned the general formulæ MCl,CrO_3 and $M''Cl_2,2CrO_3$, where M represents a monovalent metal and M'' a divalent metal. The following are the names and formulæ of the salts prepared by Péligot.

KCl,CrO_3	.. ..	Potassium chlorochromate.
$NaCl,CrO_3$	.. ..	Sodium chlorochromate.
NH_4Cl,CrO_3	..	Ammonium chlorochromate.
$MgCl_2,2CrO_3$	..	Magnesium chlorochromate.
$CaCl_2,2CrO_3$	..	Calcium chlorochromate.

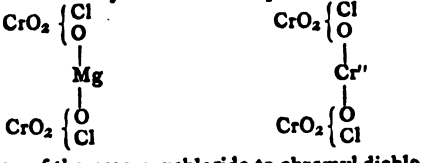
Now the new oxychloride stands in a very evident relation to these compounds. Supposing, for a moment, that the formulæ given to these substances correctly represent their constitution, then the new oxychloride may be regarded as the chromium term of the series—divalent chromium replacing magnesium or calcium.

$Cr''Cl_2,2CrO_3$,

a formula identical with that of which I have just attempted to show the impropriety. But there is still another reason for supposing that a compound thus constituted could not exist. Chromous chloride is one of the most energetic deoxidising agents known, and we can hardly conceive it to be united in a stable compound with a substance which so readily parts with its oxygen as chromium trioxide. Hence I am disposed to regard the constitution of the salts of Péligot as very different from that implied by the above method of representation: indeed, to the best of my knowledge, the general formula assigned to these salts expresses not a single experimental fact, unless it be the mode of their decomposition by water; probably it had reference to the views of Rose and Berzelius respecting the constitution of the so-called chlorochromic acid. The following structural formulæ better represent, in my opinion, the constitution of these compounds and their relation to chromyl dichloride.



These substances may also be thus represented—



The relation of the new oxychloride to chromyl dichloride is thus very apparent. Three molecules of chromyl dichloride when heated are resolved into one molecule of chromium chlorochromate and four atoms of chlorine.

PROCEEDINGS OF SOCIETIES.

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section).

The opening meeting of the session was held on Monday, the 8th instant, when Dr. Wallace, F.R.S.E., F.C.S. Vice-President, in the absence of Professor Anderson, the President of the section, delivered an address.

Dr. Wallace congratulated the members of the section upon the success which had attended their meetings during the two previous sessions, and hoped that during the present winter they would give the office-bearers of the section their cordial support in endeavouring to pro-

mote the prosecution of scientific and applied chemistry in Glasgow. The Chemical Section had been a valuable feeder to the Philosophical Society, and had been a means of encouraging the formation of other sections, as well as stimulating the enterprise of chemists in other centres of manufacturing industry. The speaker then referred to the subject of technical education, and the necessity for the establishment of chairs of technical chemistry in our universities. With regard to the munificent offer of Mr. James Young, to found a chair of technology in connection with the Andersonian University, much sympathy was felt for the eminent professor of chemistry in that institution, but they all must regret that they had not amongst them so able a man and so diligent a worker as the gentleman who had been chosen to fill the chair. It was announced, however, that Mr. Young intended to form an independent school of chemistry in Glasgow. Dr. Wallace then gave a sketch of the life and labours of the late Mr. Graham, Master of the Mint, and gave an abstract of his most recent researches on hydrogenium.

The remainder of the address was occupied with a review of the latest contributions to theoretical and applied chemistry.

The next meeting of the section will be devoted to the election of office-bearers and other business matters.

NOTICES OF BOOKS.

Chemistry: General, Medical, and Pharmaceutical, including the Chemistry of the British Pharmacopœia. By John Attfield, Ph.D. London; John Van Voorst. 1869. 8vo; 624 pages.

The object of the author in compiling this work has been to combine a lecture-companion, reading-book, and practical class-guide in one. It is specially adapted to the wants of the medical and pharmaceutical student, and, with this intention, every substance which is employed in general practice as a remedial agent is chemically described. The work opens with advice to learners regarding the method of study; in which is detailed the requirements of various examining Boards, not, as might be supposed, suggestions as to the manner in which the study of chemistry should be begun, continued, and ended—supposing any ending of such a study were ever possible.

After a short introduction, a description is given of the non-metallic elements; and we can but think that a far too brief space has been allotted to these important bodies. There is, moreover, a want of definiteness which we regret to notice; take, for example, chlorine:—

"*Source.*—This element is a gas. Its chief source is common salt, more than half of which is chlorine. *Preparation.*—About ½ of an ounce of salt, and the same amount of black oxide of manganese, are placed in a test-tube, with sufficient water to cover them. On adding a small quantity of sulphuric acid, the evolution of chlorine commences. . . . During these manipulations, the operator will have noticed that chlorine is of a light green colour. . . . The distinctive property of chlorine is its bleaching power. . . . Chlorine readily decomposes noxious gases, and hence is one of the most powerful of *deodorisers*. Used in excess, it arrests and prevents putrefaction; hence is one of the best *disinfectants*. . . . After the gases (H and Cl) have mixed, the mouths of the tubes are quickly in succession brought near a flame, when explosion occurs, and fumes of hydrochloric gas are formed."

Now, we can imagine nothing more detrimental to the student than the singular want of exactness which is exhibited here at the very outset of the work. He will very naturally imagine that chlorine is a gas under all conditions known to us; that it is readily prepared without heat; that it possesses somewhat the colour of green peas, instead of, to our eyes, a dingy yellowish green, in which the yellow predominates over the green; that its chief property is its bleaching power; that it decomposes all noxious—that is, all unwholesome, or unhealthy, or hurtful—gases; and, finally, that hydrochloric acid gas is visible. We would particularly urge Mr. Attfield to attend more to details in the next edition of his work; for a chemical treatise which lacks accuracy is of little worth, specially to the student.

The "metallic radicals" are discussed at length and with some minuteness; the principal salts are described, and synthetical and analytical reactions are given, accompanied by a symbolic representation of the changes which occur. We are glad to notice that the derivation of words is introduced as frequently as possible, and though we cannot always agree with the roots which are given, it is undeniable that even an indication of the derivation of complex words often affords much assistance to the memory of the student. We would recommend to Mr. Attfield's notice, in connection with this subject, the "Essay on Metallick Words," of Sir John Pettus; the "Lexicon Etymologicon," of Gerard Vossius; and the useful little "Etymological Dictionary," of James Donald. The account of the metallic radicals is concluded by a useful "Analytical Chart for Metals," and by certain "Analytical Memoranda."

A detail account of the "Salts of Acidulous Radicles" is next given, then "Salts of Rarer Acidulous Radicles," their analytical detection, a very concise table of the solubility or insolubility of salts in water, and a chapter on "The Analysis of Salts."

About an eighth of the work is given to the following substances:—Alkaloids, Amylaceous and Saccharine Substances, Glucosides, Alcohol and Allied Bodies, Albumenoid and Gelatigenous Substances, Pepsine, Fatty Bodies, Resinoid Substances, Colouring Matters; and the following is an example of the mode of treatment:—

"*Strychnia or Strychnine.*—Formula, $C_{21}H_{22}N_2O_2$; molecular weight, 334. *Source.*—This alkaloid exists in nux vomica (*Strychnos nux vomica*), and in St. Ignatius Bean (*Strychnos Ignatius*), chiefly in combination with lactic acid. *Process.*—According to the official process for its preparation (*strychnos*, B.P.) the nuts, disintegrated by subjection to steam, and, after drying, grinding in a coffee mill, are exhausted with spirit, the latter removed by distillation, the extract dissolved in water, colouring and acid matters precipitated by acetate of lead, the filtered liquor evaporated to a small bulk, the strychnia precipitated by ammonia, the precipitate washed, dried, and exhausted with spirit, the spirit recovered by distillation, and the residual liquor set aside to crystallise. Crystals of strychnia having formed, the mother liquor, which contains the brucia of the seeds, is poured away, and the crystals of strychnia washed with spirit (to remove any brucia) and re-crystallised." "Properties." "Reactions." "The Physiological Test," which we certainly think might be conducted in a more humane manner, although the frog is, as usual, the victim. And *àpropos* of this, we all remember how the frogs once demanded of Jupiter a king, and what they got for it; now, considering how often frogs are sacrificed on the altar of science, we do think they have a right to demand something from Jupiter in recompense therefor. If there be any believers in metempsychosis in this age, let them think how terrible would be the second death of a relative whose soul had taken up its abode in a frog selected for Mr. Attfield's "Physiological Test." "A small frog" (there is a ray of humanity in the use of the word *small*, for the size might have been left to the discretion of the experimenter) "placed in an ounce of water, to which 1-100th of a grain of a salt (acetate) of strychnia is added, is, in two or three hours, seized with tetanic spasms on the slightest touch, and dies shortly afterwards."

The chapter on "Chemical Toxicology" appears to us to be precise and accurate, but far too short (seven pages) for so important a subject. The "Examination of Morbid

Urine and Calculi" occupies eleven pages, and is accompanied by some very good plates of urinary deposits drawn by Mr. H. B. Brady, who is a careful microscopist.

The remainder of the work is devoted to "Quantitative Analysis," and occupies about one-sixth of the entire contents of the book. It is divided into the following sections:—Introductory remarks; Measurement of Temperature; Specific Gravity; Weights and Measures; Correction of the Volume of Gases for Pressure and Temperature; Volumetric Analysis; Gravimetric Analysis; Dialysis. We may specially notice a very detail table (p. 459) for the quick conversion of thermometric degrees; a long list of specific gravities of "official liquids;" and comprehensive tables of from five to seven decimal places of metrical measures and their corresponding English representatives.

Throughout the work we find at the end of each chapter a list of "Questions and Exercises," containing in all 1031 questions. These should be carefully worked out by the student, and will do much to impress facts upon his mind; it is needless to say that the only way in which they can be beneficial is if they are answered direct from memory, not after immediate reference to the book; thus a chapter should be read and if need be re-read, and a week or fortnight afterwards the questions apertaining to it should be answered.

The appendix commences with a long "Table of Official Tests for Impurities in Preparations of the British Pharmacopœia," arranged in the form of "Name of Preparation;" "Impurities;" "Test;" "Page." This will be found of the very greatest value to the pharmaceutical student, and should be so tried and tested that it is fixed in his memory. Then we have "Saturation Tables," and tables of the percentage of various acids and alkalies in solutions of various gravity, and finally a list of the apparatus and reagents required for the three months course of practical chemistry at the hospitals. We are glad to congratulate Mr. Attfield upon an unusually good index containing more than 5000 references, and extending over forty-four pages. To still further facilitate reference, three kinds of type are introduced into the index, a practice which might more often be followed with much advantage.

The work is not remarkable for any speciality of treatment or design; it bears no great stamp of originality upon it, but there is evidence of much hard work, and it is eminently comprehensive. Mr. Attfield has, however, attempted to put too much into a small space; that which is gained in variety of matter is too often lost in clearness of expression and in detail. He has laboured well at the work, and has introduced the most recent matter (such as the accounts of apomorphia and apocodeia) but what the work really wants is a careful, and by no means hurried, examination of each individual part, with a view to greater accuracy with equal conciseness; it is a grand mistake to attempt too much in books of this nature.

Now the motto and key note of the work, which is to be found over against the preface, is taken from the "De Augmentis Scientiarum" of Francis Bacon, and is to the effect that some men seek for knowledge from curiosity and inquisitiveness, love of lucre, a livelihood, or reputation, and "but few for employing the Divine gift of reason to the use and benefit of mankind." If our author will look at the original passage, he will find the above a rather loose translation of the last phrase, for it is said "Paucissimi, ut donum ratione divinitus datum in usus humani generis impendant;" and if there were any other word expressing even a less number than "paucissimi" we fear it would have to be employed. If he be among those "paucissimi" he is indeed a happy man, and we envy him. And neglecting all the other reasons for which knowledge is coveted and communicated, who can say he is not among those of whom Bacon speaks as "alii existimationis gratia?" We candidly confess we cannot. No; if this work is to have a Baconian motto at all, we venture to imagine that this will be more appropriate:—"Homo Naturæ minister et interpres tantum facit et intelligit, quantum de Naturæ ordine, re vel mente observaverit; nec amplius scit aut potest."

The Sewage Question Settled by the Purification of Water, and the Manufacture, from Town Sewage, of a Dry and Portable Manure. London, 1869.

In this pamphlet we have an account of the works of the Native Guano Company, at Leamington. If the analyses which are given are reliable, the process certainly seems of much value. The organic matter is separated from the sewage by the addition of "a *solution* of animal charcoal, blood, clay, alum, magnesia, and other chemicals;" it is then allowed to settle, and, after drying in the air, it is ready for use as a manure. The supernatant fluid is colourless, and fish have lived for months in it. The deposit is in the form of a heavy black mud, about the consistency of treacle, and scentless. The following analysis shows the composition of the solid portions of the sewage, and of the fluid which remains after the addition of the compound which precipitates the organic matter (the bulk of liquid is not mentioned):—

	Organic Matter.	Mineral Matter.	Total.
Average of 50 samples of sewage	17·2	37·4	54·6
" " " effluent water	1·4	16·9	18·3

The town of Leamington has about 20,000 inhabitants, and yields nearly 600,000 gallons of sewage daily; from this about 5 tons per day of the dried manure is procured, inclusive of 10 cwts. of ingredients added as precipitants. The dry manure, as sold, possesses the following composition:—

Water	14·1
Organic matter	22·4
Phosphate of lime	9·6
Earthy and alkaline salts	11·2
Insoluble silicates	42·7
	100·0
Nitrogen = ammonia	4·2

The cost of manufacturing the manure is £1 10s. per ton, and it sells for £3 10s. per ton; and the total amount expended on the works has been less than £4000. It is very obvious that, until the precise nature of the substances added as precipitants is made known, together with detail and repeated analyses of the sewage, and of its precipitated products, it would be very unwise to do more than call attention to the scheme, the further application of which we shall await with some interest.

MISCELLANEOUS.

Production of Oxygen Gas.—Five hundred pounds of manganate of soda furnish two and a-half cubic yards of oxygen every hour. This charge is placed in a retort, and superheated steam passed over it; in *five minutes* all the oxygen is extracted from this quantity of the salt. Hot air passed over this residue for *five more minutes* restores all the oxygen given up, and the result of an hour's continuous work, or six extractions of oxygen and six re-oxidations, is two and a-half cubic yards of oxygen. This oxygen, when it issues from the gasometers, contains about fifteen per cent of nitrogen, but, by letting the first portions escape, the quantity of this mixture can be reduced to two and a-half per cent. M. Tessie du Mothay affirms that one ton of manganate of soda will yield one hundred cubic yards of oxygen daily, or more than 36,000 per year, *and this without having to renew the salt once.*—R. J. Fowler, *in the British Journal of Photography.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

In accordance with the generally expressed wishes of our friends and readers, we have effected arrangements to enable us to give, under the above heading, notices of EVERY CHEMICAL PAPER IN THE WORLD, *as soon as possible after publication. Whenever possible, these notices will appear in the form of carefully prepared, although necessarily brief, abstracts; as respects papers either too long or too abstruse to render condensation possible, their titles will be chronicled; and in all cases accurate reference will be made to the original publication. The two half-yearly volumes of the* CHEMICAL NEWS, *with their copious indices, will therefore be equivalent to an English edition of the "Jahresberichte," with the additional advantage of keeping the readers week by week on a level with the latest advances of science.*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, November 8, 1869.

This number opens with a—

Reply to the Last Note of M. Thenard on the Subject of the Heating of Wines.—M. Pasteur.—The purport of this paper is to refute some erroneous statements made on this subject, about which a great deal more fuss is made than is consistent with its importance.

The Changes which Flowers of Sulphur and Finely-Triturated Sulphur Undergo when Brought in Contact with Certain Soils.—M. H. Marès.—The author of this paper, a wealthy landed proprietor, and a scientific man of some standing, states the following facts:—Since the year 1854, the sulphuring of vines has become a regular practice in a portion of the south of France; on an average, there has been employed about 100 kilos. of sulphur to the hectare (2·471 acres), making, in sixteen years, 1600 kilos., although the quantity has been far larger in some districts. The question as to what becomes of all this sulphur has attracted the attention of the author, who has instituted a series of experiments and observations at Launac, near Montpellier. The main result of these researches is, that the sulphur is transformed into sulphuric acid, even during the dry summer season, in the short space of time elapsing between the beginning of July and the latter end of August. Sulphate of lime is formed, in case the soil is calcareous, as in the instance alluded to. The conversion of sulphur is more rapid in case the soil has been manured, but not a trace of sulphuretted hydrogen is then given off; or, if given off at all, it is immediately decomposed by the porous substance of the soil, and oxidised to sulphuric acid. The author found sulphate of lime even to a depth of 50 centimetres below the surface of the soil, which does not contain any of that salt but the merest trace, it being a well-known fact that Montpellier, and, indeed, the greater part of the littoral of the Mediterranean, in Southern France, is made up of a tertiary limestone formation. This mode of the disappearance of the sulphur explains the necessity of constantly repeating the sulphuring operation of the vines. The author observes that it appears that the presence of sulphate of lime is a prophylactic against the attacks of the vines by the *Phylloxera vastatrix*, since the vineyards in the Département de l'Hérault, which have been regularly sulphured, are free from the attacks of an insect which ravages at present the vineyards in the neighbouring departments of the Vaucluse and Bouches du Rhône.

Transformation of the Hydrate of Chloral into Chloroform within the Animal Body.—M. Personne.—According to M. Liebreich, the hydrate of chloral should be transformed into chloroform, when coming into contact with the alkali of the blood, according to the following formula:—

$$C_4HCl_3O_2,H_2O_2 = C_2HCl_3 + C_2H_2O_4;$$

that is to say, that the hydrate of chloral should become split up into chloroform and formic acid. This statement of the Berlin gentleman above named has been found incorrect by several French chemico-physiologists; and, in order to set the question at rest, the author of this memoir has instituted a series of experiments, partly with fresh blood, and partly with live animals, and has also made other crucial experiments, with the result that the hydrate of chloral is really split up—when in contact with blood in a living animal—first, into chloroform and formic acid, which, however, are ultimately converted into chloride of sodium and formiate of soda.

Chloride of Gold.—M. Debray.—The author says, It is a well-known fact that, when chloride of gold is submitted to a temperature of about 200°, it is first decomposed into protochloride of that metal and chlorine, and, if the temperature still rises, into chlorine and metallic gold. It is, however, possible to obtain crystals of chloride of gold by sublimation, by the following process:—A current of chlorine gas is made to act upon gold beaten out to a thin foil (not gold-leaf), placed in a glass or porcelain tube, and heated to 300°, at which temperature the volatilisation takes place and ruddy-coloured crystals of the chloride are obtained. The author observes that Boyle was the first who stated that chloride of gold is volatile, to some extent, without dissociation.

Bronze fit for Sonorous Instruments.—M. Riche.—It appears that, at the request of M. Dumas, in his capacity as President of the Committee for the French Mints, the author has made a series of experiments at the Hôtel de la Monnaie, Paris, on divers alloys of bronze brought from China and Japan, containing tin and copper in the proportion of 20 and 80. There have been cast, at the works just named, bars of bronze containing, respectively, 21·5, 20·0, and 18·5 per cent of tin; these bars have been submitted to hammering at temperatures varying between bright red heat and the ordinary temperature of the air. When cold, this metal is as brittle and as breakable as glass; at from 300° to 350°, a perceptible improvement takes place; and at dull red heat the metal works as easily as iron or aluminium bronze; even under the steam hammer, the metal is flattened without breaking, and may be beaten out to sheets of a millimetre thick, but requires, if hammered, a constant annealing; while, under the rolling-mill it is even better and more rapidly wrought. When hot, the metal can be cut as if it were iron or steel; with the latter metal it agrees in having a very fine grain and being very homogeneous. It can be soldered without difficulty with jewellers' solder. The density of these alloys was found to be as follows:—Bronze with 21·5 per cent of tin, after having been cast sp. gr., 8·938—after hammering, 8·929; bronze with 18·5 per cent of tin, cast sp. gr., 8·882—after hammering, 8·938; bronze with 20·0 per cent of tin, cast sp. gr., average of three estimations, 8·914—after hammering, 8·920. These alloys are very sonorous, and similar to that of the Chinese gongs.

Yellow Coralline.—M. Laudrin.—The author states that, according to his experiments, the yellow coralline is as little poisonous as the red dye of that name, also known as peonine.

Sugar Contained in Melons.—M. Petit.—The author has carefully studied the formation, as well as the disappearance, of sugar (crystallisable cane) in various fruits. As regards the melon, the rind never contains any other sugar than glucose; the pulp contains glucose in unripe state; and while the process of ripening is proceeding, cane sugar is formed, and increases in quantity, so as to be very soon in excess of the glucose. The formation of cane sugar begins in the most sour part of the fruit—that is to say, in the pulp surrounding the seeds; the formation of cane sugar is not, therefore, due to the previous existence of glucose, nor does the former result from the latter.

Polytechnisches Journal von Dingler, first number for October 1869.

This number contains the following original papers and communications relating to chemistry or allied sciences:—

Smoke-Consuming Furnace.—M. Miguet.—The consumption of smoke remains a great desideratum for industrial as well as domestic fire-places; from what is stated in this paper, to which some engravings are added, it appears that a real improvement has been made in this direction by the author, who is not, however, fully acquainted with what has been done concerning this subject in England.

Machinery for the Manufacture of Gas from the more Volatile Portions of Petroleum.—Dr. Petersen.—After referring to the advantages of gas for illuminating purposes in general, the author reviews and describes, accompanied and illustrated by engravings, some mechanism devised by German makers, for making and burning a mixture of air and vapours of what is now called gasoline; sp. gr., 0·682. The apparatus consist mainly of an air-compressing pump and reservoir for air; and for the gasoline, which, in a current of air, if not too cold, is readily and completely volatilised, and yields, on burning from an argand burner, a light equal to 18 standard candles, while the cost is only a trifle higher than good cannel-coal gas. Gasoline, as prepared on the large scale, is quite free from sulphur and ammonia, and its combustion is complete, resulting in the production of water and carbonic acid only. The apparatus, for five lights, costs 100 thalers (£15); for 200 lights, 750 thalers (£112 10s.).

Waters Contaminated with Fatty Matters considered as Feed-Water for Steam Boilers.—M. Triepike.—The author states that it has frequently been observed that new steam boilers have become quite unfit for service in consequence of getting leaky, and that this defect is due to the fact that the feed-water often becomes contaminated with dirty grease, which is forced into the boilers along with hot water, and is derived from the grease used in packing of the piston-rods and other parts of the machinery. The author states that the addition of 1 lb. of crystallised soda upon 10,000 lbs. of feed-water, is sufficient to prevent the effect ascribed to greasy matter taking place; and this confirms the observations made by MM. Börsig and Farcot, the eminent engine-builders of Berlin and Paris.

Quantity of Metallic Lead met with in Litharge.—Dr. Wittstein.—The author refers to the well-known mode of the manufacture of litharge on the large scale, and states that a colleague of his (an apothecary) had called his attention to the fact that it had often happened to him while making *emplastrum diachylon simplex*, to discover metallic lead in the vessel wherein that operation was performed The author instituted a series of experiments, which gave, as result, that, whereas some kinds of litharge are quite pure oxide, other samples contained from 1·25 to 3·10 per cent of metallic lead in finely-divided state. Pure litharge, free from metallic lead, should dissolve freely in acetic acid. If the litharge contains lead, it remains insoluble.

Bismuth from Peru.—Dr. Barth.—Since bismuth has become a rather expensive metal, more attention has been paid to the search for its ores. The author obtained a large sample of bismuth from Peru, which, on being analysed, was proved to contain, in 100 parts:—Bismuth, 93·372; antimony, with a little tin, 4·570; copper, with a trace of iron, 2·058. This bismuth is very valuable, on account of

being quite free from arsenic and sulphur, and is very suitable for pharmaceutical use.

Coal-Tar Colours.—M. Chateau.—100 lbs. of coal-tar yield—3 lbs. of raw, and 1½ lbs. of pure benzol. This quantity yields—3 lbs. of nitrobenzol, 2·25 lbs. of rosaniline, 3·37 lbs. of aniline red, and 1·12 lbs. of fuchsine; 1 lb. of pure fuchsine requires 3,000 lbs. of pit-coal. The quantity of coal-tar produced by the entire number of gas works of Europe is sufficient to yield, annually, 53,000 cwts. of fuchsine.

Analysis of an Eatable Clay.—M. Hebberling.—The author obtained, from a friend residing at Berbek, Kedirie, Java, a clay which is eaten by the natives and regularly sold in the markets. In 100 parts, this substance contains:—Silica, 39·711; peroxide of iron, 9·806; alumina, 25·939; lime, 3·025; magnesia, 1·352; protoxide of manganese, 0·591; potassa, 0·572; soda, 3·858; water and volatile matter (including 0·506 per cent of ammonia) 14·801—of this material, 72·792 per cent is insoluble in hydrochloric acid.

Les Mondes, November 11, 1869.

This number contains the following original papers and communications:—

Instructions Given by the Conseil de Salubrité (Board of Health) concerning the Use of Domestic Heating Apparatus.

Rendering Petroleum and Paraffin Oils Uninflammable and Inexplosive.—M. Garnier.—The author somewhat verbosely discusses this subject. The main facts brought forward are that experience has sufficiently taught that the temperature of minimum inflammability at 110° F. (43°) is too low, and that, very properly, that temperature should be altered to 180° F. (82°). The author next states that it is possible to render these oils uninflammable and devoid of smell by a chemical process which is not further explained, but which, while rendering the oils absolutely safe does not interfere with their proper use and applications.

Oleaginous Plants.—M. Heuzé.—Among the *accusés de réception*, attention is called to a very useful work, treating, in a practical manner, on all vegetables the seeds of which produce oil of any kind, recording the history, cultivation, diseases, and, in one word, everything relating to this subject. The book is highly eulogised as the work of a very competent authority who holds office as Inspector General of Agriculture.

Agronomic Stations and Agricultural Laboratories.—M. Grandeau.

Preservation of Beet-Root.—Count Robrinski d'Arlovetz.—One of the drawbacks of the manufacture of sugar from beet-root has always been, and is yet, the proper mode of preservation of the roots, which, in fact, is a problem not so readily solved, and least of all in countries subject to severe winters, since, if the roots are frozen, they are spoiled. The author is a large landed proprietor in Russia (where, by the bye, the manufacture of sugar from beet-root is greatly encouraged, it being the well-known policy of the Government of that empire to become, as much as possible, independent, for articles of home consumption, from other countries). The following conditions are to be complied with for properly attaining this object:—(1) No root should be at more than one metre's distance from a proper current of air; (2) every cubic metre of beet-roots requires at least a surface of 30 square decimetres, freely exposed to air; (3) that the cellars in which the roots are stored be aired every day, and care taken that the temperature therein does not rise above 4°; (lastly) care has to be taken that the roots do not become flabby by evaporation of too much water (10 to 12 per cent of their weight), in which case it would be necessary to water the roots, which, however, is always a dangerous proceeding, since it may lead to putrefaction.

Preservation of Stone by the Use of the Black Oxide of Copper and its Salts.—Dr. Robert.—This paper treats on a very interesting subject. The author proves that the decay of stone, granite, marble, limestones, sandstones—in a word, all natural building stones—is the effect of a concourse of various causes, and that among these a very minute lichen, the *Lepra antiquitatis*, is one of the worst enemies of the stone; and this to such an extent that, for instance, the beautiful marble sculptures of the well-known Parc de Versailles, will, unless proper measures are taken for staying the process of decay, be unsightly and ugly masses of dirt, and quite irretrievably lost as works of art within another fifty years. The author, taking as instances such buildings, at Paris, as the Bourbon Palace, the Palais du Corps Législatif, the Mazarin Palace (l'Institut), the Mint, and others, points out that dust, spider's-webs, and the action of rain combine with the minute lichen above alluded to, to call forth the decay of stone, especially of such parts, first, where any sculpture or ornamental carving promotes the deposition of dirt and dust. The author conclusively proves (and brings on instances which every one can see, and which, moreover, are important, in consequence of the length of time which has elapsed since the protective action of the black oxide and salts of copper commenced), that the action of the two last-named substances is, undoubtedly, preservative to stone. In reference to granite, the author states that (and an instance thereof can be seen at Waterloo Bridge) this stone is, also, according to the experience of Egyptian engineers, far more readily affected by a moist climate than one would be led to believe. The obelisk of Luxor, brought from Upper Egypt to Paris, has become blanched and full of small cracks during the forty years it has stood on the Place de la Concorde, while forty centuries had not perceptibly affected it as long as it was in Egypt. Granite, in a moist clime, becomes the seat of a microscopically-small cryptogamic plant, which greatly aids destruction; and it is, moreover, a well-known fact, that the disintegration of this stone, consisting of three separate minerals (quartz, mica, and felspar), depends very greatly upon the thorough and intimate mixture, as well as upon the chemical composition, of the same, each of these minerals, separately, being readily enough weathered.

Cultivation of Sugar-Cane in New Caledonia.—M. Joubert.—It appears, from a letter written by the person just named, that New Caledonia will become a sugar (cane) producing country. There are two sugar works in existence already, and two others are being built; the necessary machinery having been shipped from the Ile de la Réunion. Since it is a well-known fact that Cuba and other countries from which a very large proportion of the supply of sugar is obtained, are rapidly on the decline, as regards quantity, it is a gratifying fact to find that the country above named will soon be enabled to supply a not inconsiderable amount of this commodity.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 15, 1869.

From the *procès verbal* of the first meeting of this Society held after the holidays, we learn that, among other foreigners, the following Englishmen have been elected members:—Professor Crum-Brown, of Edinburgh, and Dr. W. Kellner, of Woolwich. The president, Prof. A. W. Hofmann, alluded, in a few words, to the death of the late lamented Mr. T. Graham, who was an honorary member of this Society. As a token of respect to the deceased *savant*, the assembly rose *en masse*, and a deep silence was observed for a few moments. The president next exhibited to the members a medal made of the alloy of palladium and hydrogenium, sent over by the late *savant* just alluded to, a few days before his death, to Professor Magnus, of Berlin; this medal bears on one side the effigy of Her Majesty Queen Victoria, and on the other side the name of Graham and the words "Palladium-Hydrogenium, 1869." There is added to the medal a short paper, which states that the medal contains 900 times its own bulk of hydrogenium, and, since the thickness of the medal is 1 m.m., a layer of hydrogen of a height of nearly 1 metre is condensed in that thickness of metal.

The following papers were read:—

On Chromates.—M. C. Freese.—The researches on this subject extend over a series of the salts alluded to, beginning with silver. The author distinctly points out that there exist only a neutral and a bichromate of the oxide of that metal, but no basic salt. The protoxide of mercury yields a normal neutral salt. By precipitating an excess of HgN_2O_6 with $K_2Cr_2O_7$, the precipitate obtained is not decomposed by washing with water. There exists only one basic chromate of peroxide of mercury. The older works on chemistry speak of basic chromates of copper of a green colour; the author says that green colour is due to basic sulphate of copper, or to hydrated oxide. The only known and well-defined chromate of copper, Cu_2CrO_4+2aq, is brown-coloured. Cupro-chromate of potassa is produced when cold solutions of $CuSO_4$ and K_2CrO_4 act upon each other; the double salt so obtained is split up by boiling water into K_2CrO_7 and sesquichromate of copper—

$$KrCu_2Cr_2O_{10}+2aq=(K_2Cr_2O_7)+(Cu_2CrO_6+2aq).$$

The chromates of zinc, cadmium, nickel, and cobalt are briefly alluded to, as, also, the basic chromate of protoxide of manganese.

On Sulphine Compounds.—M. Dehn.—The author says—Since it has been proved by M. Oefele that, when sulphide of ethyl acts upon iodide of ethyl, there is formed a monatomic radical, wherein the nitrogen is replaced by sulphur, I have tried to obtain similar compounds from diatomic alcohol radicals, using the sulphide of ethyl and bromide of ethylen as starting-point for my experiments. When these substances are heated in sealed tubes, along with water, to about 130°, two different series of action and products are observed; among these, triethylsulphine-platinchloride was obtained—

$$\left.\begin{matrix}\overset{I}{C_2H_5}\\ \overset{I}{C_2H_5}\\ \overset{I}{C_2H_5}\\ Cl\end{matrix}\right\} S,PtCl_2;$$

also ethylen-diethylsulphine-platinum-chloride—

$$\left.\begin{matrix}\overset{II}{C_2H_4}\\ \overset{I}{C_2H_5}\\ \overset{I}{C_2H_5}\\ Cl_2\end{matrix}\right\} S_2PtCl_2$$

also trimethylsulphine-bromide, C_3H_9SBr. In 100 parts—Carbon, 22·93; hydrogen, 5·75; sulphur, 20·38; bromine, 50·96. The paper enters into a lengthy discussion on the labours of MM. Cahours, Kolbe, and others on this subject.

Calculation of the Heat Emitted by the Combustion of Organic Compounds.—M. Thomsen.

Contribution to the History of the Salicylic Compounds.—M. Henry.—This is the third portion of a memoir on this subject, subdivided into the following sections:—Nitrile of salicylic acid—

$$C_6H_4\begin{matrix}<HO\\ CN\end{matrix}$$

Nitrile of benzoyl-salicylic acid—

$$C_6H_4\begin{matrix}<(C_7H_5O)O\\ CN\end{matrix}$$

Metachlorobenzonitrile—

$$C_6H_4\begin{matrix}Cl\\CN\end{matrix}$$

Metachloronitrobenzonitrile—

$$C_6H_3(NO_2)\begin{matrix}Cl\\CN\end{matrix}$$

New and General Method for the Formation of Nitriles.—M. Henry.—The concluding portion of a long essay on this subject.

Some Sulphuretted Compounds of Isopropyl.—M. Henry.—This paper treats of:—Sulphocyanide of isopropyl, $C_3H_7.CNS$, a fluid of 0·963 sp. gr. at 20°, boiling at about 150°. Sulphur isopropyl, $(C_3H_7)_2S$, boils at 105°, and enters into combination with several metallic chlorides, the mercurial compound being a crystalline substance of the following formula:—$(C_3H_7)_2S,HgCl_2$. Mercaptanisopropyl, $(C_3H_7)HS$, boils at 45°, and acts energetically on peroxide of mercury, yielding a crystalline compound, $(C_3H_7)2HgS_2$; the alcoholic solution of this substance yields, with salts of lead, yellow-coloured precipitates, with acetate of copper a white-coloured precipitate, and the same with solutions of the salts of peroxide of mercury.

Some Derivatives of Oxybenzoic Acid.—M. Heintz.—The author describes the following substances:—A diethylether—

$$C_6H_4.OC_2H_5.COOC_2H_5,$$

a clear, colourless, oily liquid, boiling at 263°; its sp. gr., at 20°, is 1·0725; at 0°, 1·0895; its co-efficient of expansion is 0·000735. On saponification, this ether yields an acid, $C_6H_4.OC_2H_5.COOH$, a solid substance fusing at 137°; it yields salts with potassa, baryta, lime, and oxide of silver. Acetoxybenzoic acid, $C_6H_4.OOCCH_3.COOH$, a solid fusing at 127°, readily yielding salts with alkalies and the alkaline earths. Oxybenzoic-monethyl-ether, a fluid; formula—

$$C_6H_4.OH.COOC_2H_5;$$

freezes at −12°, but does not become fluid again until at 72°. (All the formulæ here quoted are exactly reproduced from the original.)

Action of Chloride of Mercury upon Sulphocarbanilide and Sulphocarbotoluide at a Higher Temperature.—M. Buff.—After referring to the experiments of MM. Merz and Weith on this subject, the author says—When a mixture of finely-powdered chloride of mercury and sulphocarbanilide is heated to about 150°, the mixture first fuses, next begins to give off a quantity of hydrochloric acid and sulphuretted hydrogen gases, and after the lapse of many hours the mass exhibited the odour of phenylsenföl (phenylated essential oil of mustard); while in the neck of the retort some crystals of hydrochlorate of aniline were found. The mass in the retort was first treated with boiling water, and next with alcohol, leaving a residue of mercury and sulphur; by this process, a basic substance, soluble in water, was obtained, which has been called tricarbohexanilide by MM. Merz and Weith, and triphenyl-guanidine by Prof. A. W. Hofmann. This substance fuses at 145°; when it is heated with sulphuric acid, sulphanilic acid is formed. The alcoholic solution yielded a solid crystalline matter, fusing at 235°, and exhibiting all the characteristics of a phenylated urea. When sulphocarbotoluidide is treated in the same manner, but at a temperature between 165° and 180°, a mass was obtained which exhibited a strong odour of oil of aniseed; the mass was at once exhausted with alcohol, yielding, after a complex process of purification, crystals of tritolylguanidine and sulphocarbotoluidide. The formation of tritolylguanidine is explained by the following formulæ:—

$$CH_3-C_6H_4\left.\begin{matrix}\\H\end{matrix}\right\}N-C(=N)-\left\{\begin{matrix}C_6H_4-CH_3\\H\end{matrix}\right.$$

$$C_6H_5-CH_3$$

A New Phosphamide.—M. Wichelhaus.—After referring to the labours of MM. Fittig, Gerhardt, Kekulé, and others, the author points out that, when phosphorus perchloride acts upon benzol-sulphamide, the product of that reaction need not be, as is generally supposed, benzol-sulphamide-chloride. On repeating the experiment, the author obtained, by means of a complicated set of reactions, a substance, $C_6H_6SO_2NPCl_2$; the reaction should, therefore, be represented by the following formula:—

$$C_6H_5.SO_2NH_2+PCl_5.Cl_2=Cl_2+HCl+C_6H_5.SO_2NHPCl_2.$$

The substance resulting from the benzolsulphamide appears to be a phosphamide, and is called by the author *benzolsulphurylbichlorphosphamide*—

$$\begin{matrix}NH(C_6H_5.SO_2)\\PCl_2\end{matrix}$$

Under the title of "Correspondence," M. V. von Richter writes from St. Petersburgh as follows:—The study of chemistry and the number of scientific chemists has of late years so rapidly increased in Russia that, after a general meeting of scientific men of the empire (held at the capital, in January, 1868), the Government permitted (on the 28th of October of that year) the establishment of a Chemical Society for the empire, upon the conditions that the seat of the Society should be the capital city, and that none but really scientific chemists should be elected as members. The president of the Society is elected for five years consecutively, and this office is held by M. Zinin. The meetings take place monthly, except the three summer months; at the meeting of 11-23 September last the following communications were made:—

Action of Iodine upon the Silver Compound of Succinimide Dissolved in Aceton.—M. Menschutkin. Iodine of succinimide is obtained in crystals belonging to the quadratic system; at 153°, this substance is decomposed, succinimide being again formed. Iodine does not act upon the sodium combinations of formanilide and acetanilide.

Bensimide.—M. Zinin.—The author states that, when this substance (formula, $C_{28}H_{16}N_2O_2$) is heated, along with water, in sealed tubes, it is split up into oil of bitter almonds and the amide of an acid as yet not well determined.

Nitrotoluol.—MM. Beilstein and Kuhlberg.—The authors exhibited a series of preparations of this substance; among these, solid nitrotoluol, boiling at 237°, and fluid nitrotoluol, boiling at 221°. The latter yields fluid isotoluidine.

Preparations of Thymol.—MM. Engelhardt and Latschinoff.—When thymol is acted upon by anhydrous phosphoric acid, propylen and γ cresol is formed. This latter substance differs from α and β cresol, which are obtained from two toluol-sulpho acids; but the boiling point of these three cresols is 190°. This concludes the correspondence from St. Petersburgh.

On Ethylenferrochloride.—M. J. Kachler.—When an ethereal solution of chloride of iron is heated for some hours in a sealed tube up to about 150°, a solid greyish-coloured substance is obtained. The author finds that this substance is, after having been purified, a compound $C_8H_4.Fe_2Cl_2+2H_2O$. The formation of this substance is represented by the following formula:—

$$\left.\begin{matrix}C_2H_4\\2C_2H_5\end{matrix}\right\}O+2Fe_2Cl_6=2(C_2H_4.Fe_2Cl_2)+2\left\{\begin{matrix}C_2H_5\\H\end{matrix}\right\}O+2Cl.$$

This compound is not formed when the ether is perfectly anhydrous, and could not be obtained when, instead of ether, alcohol was used.

Balsam of Peru.—M. Kachler.—The author first reviews the labours of the large number of scientific men who have taken up and investigated this subject; and next describes, at very great length, his experiments, which gave, as result, that 100 parts of this balsam consist of 20 parts of benzile alcohol, 46 parts of crude cinnamic acid, and 32 parts of resin. There is appended to his paper a critical review of the labours on this same subject recently published by M. Delafontaine, from which it appears that the Peru balsam of commerce is a substance of variable composition, as has been very frequently brought forward and proved by scientific as well as pharmaceutical chemists.

Some Derivatives of Succinyl.—M. Weselsky.—The author describes:—Succinyl-phenol—

$$\left.\begin{matrix}C_4H_4O_2\\2(C_6H_5)\end{matrix}\right\}O_2,$$

is insoluble in water; soluble in ether, sulphide of carbon, and benzol; fuses at 118°; and boils and distils over, without decomposition, at 330°. Sulpho-succinate of potassa—

$$\left.\begin{matrix}C_4H_4O_2\\K_2\end{matrix}\right\}S_2,$$

is a solid substance, readily soluble in water, alcohol, and ether, and readily decomposed by acids, sulphuretted hydrogen being evolved. Sulpho-succinic acid, $C_4H_6O_6S$, also called sulpho-succinyl, is very soluble in water, alcohol, and ether, and exhibits a strongly acid reaction; with solutions of salts of copper, it is immediately decomposed, sulphide of copper being formed.

On Biniodide of Phenol.—MM. Hlasiwetz and Weselsky.—In the introduction to this paper, the authors review the history of some isomeric monoiodine phenols, and other compounds of phenol and iodine. Pure biniodide of phenol is a crystalline substance, readily soluble in alcohol, ether, and sulphide of carbon; fusing at 150°; subliming at a higher temperature; formula, $2C_6H_4I_2O+2H_2O$.

Products of the Oxidation of Toluol-Sulpho Acid by means of Fusing Caustic Potassa.—M. Barth.—This paper, and the next (by the same author)—

Constitution of Phloretinic Acid and Tyrosine—Are not well suited for abstraction.

On Sulphoxybenzoic Acid.—M. Senhofer.—By a lengthy process, too long for quotation, the author obtained sulphoxybenzoic acid in pure state. It is a crystalline bright green-coloured substance, $C_7H_7SO_6$, not precipitated by neutral acetate of lead, and yielding, with chloride of iron, a wine-red colour; at 160°, it loses water; the acid fuses at 208°. This acid forms compounds with lead and cadmium; the latter is an acid salt. Formula, $2(C_7H_6SO_6)Cd$. The acid does not readily form salts with alkalies.

New Mode of Formation of Protocatechusic Acid.—M. Malin—The author finds that, when sulphanisic acid is heated with fusing caustic potassa in excess, care being taken to regulate the temperature properly, and to avoid a too long continued action of the potassa, the result is the formation of protocatechusic acid; when the action is too long continued, hydrochinon is, however, formed. The acid obtained was found, on elementary analysis, to yield—C, 54·7; H, 4·0. Dried at 100°, this substance lost 10·5 per cent of water. The quantity of protocatechusic acid obtained from 16·6 grms. of sulphanisic acid amounts to about 2 grms.

Pettenkofer's Method for the Determination of Carbonic Acid.—Dr. Gottlieb.—The author states that, while, with the method alluded to, the accuracy thereof mainly depends on the care taken in the preparation of the turmeric paper used in this process (which is not described, but understood to be generally known), he has found that, when proper precautions are taken, the pigment of litmus answers the purpose as well. For this purpose, the litmus is exhausted with alcohol at 85 per cent, until it only assumes a very slight violet tinge. The alcohol is removed by evaporation on a water-bath, leaving behind a deep violet-coloured amorphous mass, the largest part of which is soluble in cold water, yielding a solution which, on the addition of an acid, assumes the well-known red colour, known as *rouge pelure d'oignon*, while alkalies do not affect it. The remainder of the litmus (insoluble in alcohol) is treated with water, yielding a blue pig-

ment insoluble in alcohol; this aqueous solution is, after removal, by filtration, of the substances of the litmus insoluble in water (impurities), at first, violet-blue coloured; but this tinge changes, on the addition of more water, into a pure blue, which, by the addition of acids, soon becomes beautifully red (*pelure d'oignon*), which tinge, however, does not become apparent unless a larger quantity of acid has been added. The author, therefore, adds to a portion of the blue-coloured fluid guttatim, some very dilute hydrochloric acid, until the fluid has assumed a wine-red tinge. When this point has been reached, the rest of the blue (original) liquid is added; and in this manner a fluid is obtained which answers the purpose of working, according to Pettenkofer's method, better than turmeric paper or tincture, since the author states that, on instituting comparative tests and assays, he found it easy to estimate to within 0·0007 grm. of carbonic acid.

NOTES AND QUERIES.

Bisulphite of Lime.—How is the "bisulphite of lime solution" which is now largely sold, possessing as high a gravity as 1·072, practically made?—A. N. Palmer.

Shoddy.—Can any of the subscribers of your valuable journal inform me the best means of reducing shoddy by acid, for mixing with phosphatic material as a manure.—Child.

Preventing Moisture in Glass Cases.—(Reply to "S. E. P.")—Use quick-lime, which absorbs both moisture and carbonic acid, and put in the case a piece of camphor wrapped in muslin, and you will not be troubled with moisture.

Standard Verification.—(Reply to "S. E. P.")—We believe that a polite application to the Astronomer Royal would obtain you what you desire; there is no doubt that at the Observatory they have the means as well as the goodwill to give every assistance for such objects.

Bleaching Syrups.—(Reply to "Andrew Van Bibber").—You can hardly expect to attain your object at all, since the colour of these syrups is due, in the first place, to caramel, and also to peculiar impurities, from which the sugar is only liberated by a process of washing with a very concentrated, and quite colourless, syrup made on purpose from best refined sugar. Filtration through charcoal (animal) will decolour these green syrups, as they are technically called, to a limited extent, and then only after having been somewhat diluted with hot water, and the filtration taking place in a room where the temperature should not be less than 80° F. By means of very finely divided pipe-clay, added previous to filtration, you may obtain a greater degree of decolouration, but it is impossible to bleach, as you call it, these syrups entirely, and since you have to dilute with water before filtration, you would have to evaporate that water afterwards, and unless that were done in a vacuum pan, your previous operations would be of little avail.—X.

Detection of Prussian Blue in Black Ink.—Prussian blue is either neutral or basic. Neither of these are soluble in water; for, although it is stated that the basic blue is soluble therein, this is incorrect, since the apparent solubility is due to an excess of the ferrocyanide of potassium. There is no means of dissolving Prussian-blue but by the use of acids, which would altogether destroy, and be incompatible with, black ink as usually made, since these acids are just those which are used to obliterate the stains of black ink. Prussian blue is decomposed by alkalies; but these would also destroy ordinary black ink. It is not very likely that ink should be tinged blue by Prussian-blue; it is probably coloured blue by a few drops of indigo carmine. As to the detection of logwood in ink, it should be borne in mind that almost all black inks are partly made with logwood, and that a tolerably good black ink is made of logwood decoction and neutral chromate of potassa. The detection of logwood is based upon the reactions of hæmatoxyline and hæmateine, but the details thereof are too lengthy to be here quoted, and can be found in works on organic chemistry.

Terra Alba.—In further reply to "Selenite," it depends upon what purpose he intends or wishes to apply it—which variety is to be preferred. Chemically, they are all the same, except that the commoner kinds contain more or less foreign matter, such as oxide of iron, &c. The best kind is carefully picked out and ground into what is technically termed "terra alba," and by some people "pearl white;" this portion is so white that it looks like good loaf-sugar. The more coloured varieties, or parts of the vein (*i.e.*, the pieces rejected as unfit for terra alba), are ground up separately, and are technically called gypsum. These kinds need no drying; but when either kind is baked, so as to lose its water of crystallisation, it becomes the setting plaster, known as plaster of Paris, used by plasterers. Terra alba (*i.e.*, the natural product) is sold very much cheaper than the artificial one made under Jullien's patent. French artificial sulphate of lime is made like Jullien's, by precipitation, I think, by Prof. Kuhlmann, but it is no better than native terra alba, or Jullien's pearl-hardening. As the artificial article would, if over-dried, lose parts of its water of crystallisation, it is never thoroughly dried. It is almost impossible to enumerate the many uses to which gypsum (a term which includes the whole) is applied; it is, however, largely used for manure, as an absorbent of ammonia, by colour makers, paper makers, and several other trades. Large quantities of the commoner kinds are made in Carlisle and that neighbourhood, and quantities of the stone are shipped, from the Seine, to Leith and other places, where it is ground, but the French stone is not good enough to make terra alba. If "Selenite" sends me his address, I will send him a pamphlet on the subject, containing the largest amount of information he can get about it, and which would be too much to be given through your columns. Jullien's patent is an English one.—Nemo.

MEETINGS FOR THE WEEK.

Monday, 22nd.—Medical, 8.
—— London Institution, 4.
Wednesday, 24th.—Society of Arts, 8.
—— Geological, 8.
Thursday, 25th.—London Institution, 7.30.
—— Royal, 8.30.
—— Zoological, 8.30.
Friday, 26th.—Quekett Club, 8.

TO CORRESPONDENTS.

R. Tatlock.—Communication received with thanks.

D. W. L.—Bloxam's "Laboratory Teaching," published by Churchill, will answer your purpose best.

J. B.—(1) A good cement for sulphide of carbon prisms is isinglass dissolved in weak spirit. (2) Heat and good ventilation will remove the smell of wood-tar from a room.

Professor Tennant, F.G.S., will deliver a Course of Lectures on MINERALOGY applied to GEOLOGY and the ARTS, at King's College, London, on Wednesday and Friday mornings, at nine o'clock, during October, November, and December, commencing October 8th. Fee, £2 2s.

A Course of Lectures on MINERALOGY and GEOLOGY will also be delivered, on Thursday evenings, at eight o'clock. These begin October 14th, and will be continued to Easter, 1870. Fee, £1 11s. 6d. Professor Tennant gives Private Instruction in Mineralogy and Geology, Illustrated by a large number of Specimens, at his Residence, 149, Strand, W.C.

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TO PHARMACEUTICAL AND OTHER STUDENTS.

Mr. J. C. BRAITHWAITE, for thirteen years Principal Instructor in the Laboratories of the Pharmaceutical Society of Great Britain, and Demonstrator of Practical Pharmacy, Pharmaceutical Latin, &c., wishes to inform his old Pupils and others that he continues to devote his whole attention to Education.

The Session 1869—1870 will commence on the 4th of October, when Mr. BRAITHWAITE'S Laboratory, which has been enlarged, will be re-opened at 10 a.m. for Instruction in Practical Chemistry as applied to Pharmacy, Medicine, Analysis, &c. Pupils can enter at any period. Terms moderate.

THE CHEMICAL and TOXICOLOGICAL CLASS meets as usual every Monday and Thursday Evening, at 8 p.m., commencing October 4th.

The LATIN CLASS for the reading of the Pharmacopœia, Physicians' Prescriptions, &c., every Tuesday and Friday Evening, at 8 p.m., commencing October 5th.

The BOTANICAL and MATERIA MEDICA CLASS, every Wednesday and Saturday Evening, at 8 p.m. The usual EXCURSIONS for the STUDY of PRACTICAL BOTANY will be continued every Saturday until further notice.

Fee to either of the above Classes Half-a-Guinea per Month; to the Botanical Excursions only, Half-a-Guinea per Eight Lessons. Pupils can enter at any period.

Gentlemen privately prepared for the Examinations of the Pharmaceutical Society, &c., the "Special Examination for Chemists in Business," and for the "Modified Examination for Assistants."

All Fees must be payable in advance.

Letters of inquiry should be accompanied with a stamped envelope Address, 54, Kentish Town Road, N.W.

Mr. Braithwaite receives a few Pupils to board in his house.

THE CHEMICAL NEWS.

Vol. XX. No. 522.

THE LATE ECLIPSE, AND ITS OBSERVATIONS IN THE UNITED STATES.

As might be expected from the easy accessibility of the entire line of totality, this eclipse has been most thoroughly observed by numerous parties, the report of whose work will in due time be presented to the scientific world. Among the methods of observation, photography played an important part, and we have now before us an admirable series of views obtained by a large party organised and conducted by Dr. Henry Morton, Professor of Chemistry in the University of Pennsylvania, whose communications have sometimes appeared in our columns.

These pictures show, in the first place, very fine definition in the telescope employed, as the roughness or mountainous character of the moon's edge is clearly given in the pictures of partial phase, as well as the sun-spots and surrounding faculæ.

Thus, Professor A. M. Mayer, who took charge of one of the three sections of Professor Morton's party, has shown, by measurement on the photographs, a change of shape in one of the larger spots during the eclipse, amounting to a motion of 2000 miles in its edges.

During totality, no less than thirteen negatives were secured, showing a large number of prominences, some massive and others delicate, as well as radiant brushes of a softer light, such as have been before seen, but never as yet photographed. By another of the sections of this large party, beside similar pictures to the above, one was obtained showing the curious phenomena known as Baily's beads.

The time of exposure determined by Professor Mayer for the partial-phase pictures was the 1-500th of a second. Those taken during totality were exposed from five to sixteen seconds.

The *Journal of the Franklin Institute* for September has sixteen pages devoted to Professor Morton's report of his expedition to Professor J. H. C. Coffin, U.S., N. Supt. of the *Nautical Almanack*, under whose authority this and other expeditions were organised, with an admirable photograph from one of the totality negatives, and several woodcuts.

One of these, showing the general character of the prominences, we here give.

The line A B represents the direction of a parallel of declination; C D a declination circle. F E is the moon's path from first contact at F. The prominences are here all shown at once; although, of course, those on the sun's eastern limb alone were seen at first, those on the west side only at the end of the totality.

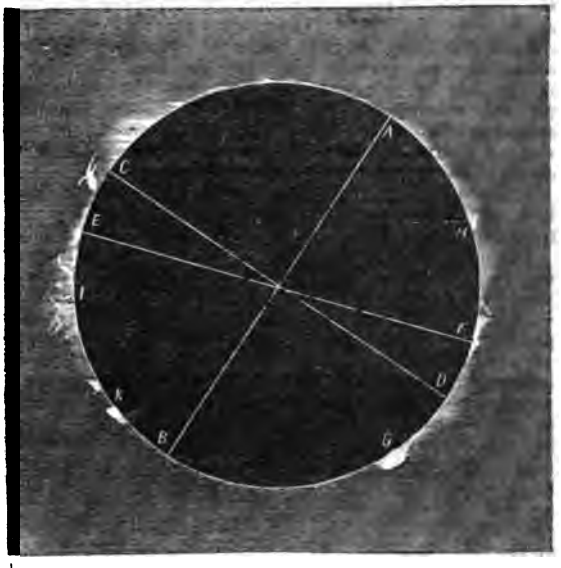
In the October number of the same journal, of which advanced sheets have been sent us, thirty-eight pages are devoted to the reports to Dr. Morton of those in charge of the various departments. From these we extract some of the most interesting portions as follows.

Photographs of the Chromosphere.

Dr. B. A. Gould writes:—An examination of the beautiful photographs made at Burlington and Ottumwa by the sections of your party in charge of Professors Mayer and Himes, and a comparison of them with my sketches of the corona, have led me to the conviction that the radiance around the moon in the pictures made during totality is not the corona at all, but is actually the image of what Lockyer has called the chromosphere.

This interesting fact is indicated by many different considerations. The directions of maximum radiance do not coincide with those of the great beams of the corona; they remained constant, while the latter were variable. There is a diameter approximately corresponding to the solar axis, near the extremities of which the radiance upon the photographs is a minimum, whereas the coronal beams in these directions were especially marked during a great part of the total obscuration. The coronal beams stood in no apparent relation to the protuberances, whereas the aureole, seen upon the photographs, is most marked in their immediate vicinity; indeed, the great protuberance, at 230° to 245°, seems to have formed a southern limit to the radiance on the western side, while a sharp northern limit is seen on all the photographs at about 350°, the intermediate arc being thickly studded with protuberances which the moon displayed at the close of totality. The exquisite masses of flocculent light on the following limb are upon the two sides of that curious prominence at 93°, which at first resembled an ear of corn, as you have said, but which, in the later pictures, after it had been more occulted, and its southern branch thus rendered more conspicuous, was like a pair of antelope horns, to which some observers compare it. Whatever of this aureole is shown upon the photographs was occulted or displayed by the lunar motion, precisely as the protuberances were. The variations in the form of the corona, on the other hand, did not seem to be dependent in any degree upon the moon's motion.

The singular and elegant structural indications in the special aggregations of light on the eastern side may be of high value in guiding to a farther knowledge of the chromosphere. They are manifest in all the photographs by your parties which I have seen, but are especially marked in those of shortest exposure, such as the first one at Ottumwa. In some of the later views, they may



be detected on the other side of the sun, though less distinct; but the very irregular and jagged outline of the chromosphere, as described by Janssen and Lockyer, is exhibited in perfection.

This happy result is clearly attributable to the relative shortness of the time of exposure, by which the highly photographic rays of the chromosphere have depicted themselves, without obliteration by the mass of coronal light which veiled them from the eye. Let us hope that, at the next total eclipse, some impressions may be taken with an exposure not exceeding a single second. The inference seems warrantable, that, in this way, better than in any other, the internal structure of the protuberances

may be exhibited, though other phenomena may fail to record themselves.

You will observe that some of the brighter, petal-like, flocculi of light have produced apparent indentations in the moon's limb at their base, like those at the bases of the protuberances. These indentations are evidently due to specular reflection from the moon's surface, as I stated to the American Association at Salem, last month. Had any doubt existed in my mind, previously, it would have been removed by an inspection of the photographs.

Abstract of Professor Young's Report.

The observer was a member of the party under the direction of Professor J. H. C. Coffin, of the *Nautical Almanac* Office, stationed at Burlington, Iowa.

The instrument employed was a spectroscope with 5 prisms of 45° each, having faces 2¼ by 3¼ inches; the collimator and telescope had apertures of 2¼ inches, with a focal length of 17. These were connected with a "comet seeker" of 4 in. aperture and 30 in. focus, used with an eye-piece, and giving an image of the sun, 2¼ inches in diameter, on the slit of the spectroscope. A graduated screen at the slit determined positions of points on the sun's limb, and a wire micrometer measured the positions of spectrum lines. The whole was mounted equatorially with slow motion screws.

Protuberances were noted before the eclipse at + 85° to 100°, large and not very bright; at + 146°, small and bright. The photographs show another at 155°, which escaped notice; also at −70° to 80° low, but pretty bright; and at −130°, very large and bright, the principal one. Angles are reckoned on the sun's limb from the North point, + towards the East, − towards the West.

The first contact was observed by watching the gradual shortening and final extinction of the *bright line*, C, in the spectrum of the prominence, which happened to be at the point of contact. The moon's approach was perceived full thirty seconds before its actual appulse; the observation was perfectly easy, and the time determined is certainly to be relied on within half a second, and probably much less. The presence of a prominence at the point of contact is not essential to the success of the method, as there is everywhere on the sun's limb sufficient depth of chromosphere to answer the purpose.

It is proposed to apply the spectroscope to observations both of the external and internal contacts at the next transit of Venus.

During the totality, the following nine bright lines were observed in the spectrum, viz., C, dazzling in brilliance; 1017·5 (near D, the numbers refer to Kirchhoff's scale,) very bright, but not equal to C; 1250±20, very faint, position only estimated; 1350±20, like the preceding; 1474 (a little below E,) conspicuous, but not more than half as bright as 1017·5; F, next to C in brightness; 2602±2, a little fainter than 1474, position determined by micrometrical reference to the next; 2796, a little below G, the well-known Hγ line in brightness between 1017·5 and 1474; and finally *h*, or Hδ, somewhat brighter than 1474. *b* was not seen, it is supposed, on account of a mistake in carrying that portion of the spectrum through the field while there was no prominence on the slit.

*The line 1474 was recognised as belonging to the *spectrum of corona*, in the first place, by its extending clear across the spectrum, while 1017 did not, and then by its remaining visible when the slit was moved away from the protuberance, while the other lines (C and 1017) disappeared. The impression of the observer is that faint lines 1250 and 1350 behaved in the same manner, but his recollection as to this point is not very certain.

These three lines, 1250, 1350, and 1474, coincide far within the probable errors of observation with three lines observed by Prof. Winlock in the spectrum of the Aurora Borealis. The first two are not accurately enough determined, in position, to allow much stress to be put upon any apparent coincidences on their part, but the last is perfectly well known, and its exact agreement throughout with one of the fainter lines of the Aurora, when combined with the general appearance of the Corona and other considerations, give a good deal of probability to the conjecture that *our Aurora Borealis and the Solar Corona are identical phenomena*.

The line 1474 is given by both Kirchhoff and Angström (not by Huggins, who, however, omits many faint lines,) as belonging to the *iron* spectrum, and this suggests the inquiry whether we are to admit the existence of *iron* in the auroral heights of our atmosphere, or are to account for this line in the iron spectrum by some unknown substance of gaseous nature.

The corona showed, also, a faint continuous spectrum without *any trace of dark lines*. The light of this faint spectrum, tested by a tourmaline held in the hand next the eye, was strongly polarised in a plane passing through the sun's centre. As the direction of the spectroscope slit was nearly radial, it is not impossible that Prof. Pickering may be right in explaining this polarisation as caused by the successive refractions through the prisms.

Professor Young's Determination of First Contact.

In our notice of this subject we omitted to state that Prof. Young finds that the presence of a prominence at the point of first contact, though facilitating the process is not essential to his method, since the spectrum of the chromosphere is quite enough for the same purpose.

The Corona and its Photographs.

It is a very fortunate thing that the numerous parties by whom photographs were made of the late eclipse, is hardly any two instances followed the same plan of arrangement or aimed at the same class of results. Thus, the Philadelphia Expedition, in pursuance of Professor Coffin's suggestions, made their preparations with the view of obtaining such "accurate and well-defined pictures as might be the basis of astronomical calculations." In this they have unquestionably succeeded beyond all others, as we hear from all sides, now that pictures have been distributed and compared. Their views of lunar mountains, sun-spots, faculæ, chromosphere, and crepuscule being unapproached, and their views of the solar prominences only rivalled by one obtained by Dr. Curtis.

The party under Prof. Pierce, consisting, photographically, of Mr. Whipple, of Boston, (who, with Mr. Black and the late Prof. Bond, of Cambridge, made, in 1850, the first celestial photograph), addressed themselves exclusively to the recording of that strange phenomenon, the corona. To secure any impression from this object, which, notwithstanding its apparent brightness is remarkably deficient in photographic power, it was necessary to make a very small image, and to give a very long exposure.

The telescope was therefore arranged to produce an image in its principal focus simply, and during the totality an exposure of 40 seconds was given. By this means a picture was obtained, of which the accompanying cut is a very careful copy. From the long exposure and motion of the moon, as also, probably, of the light in the corona, there is little sharpness of definition,

* A careful examination of the photographs of the prominences on the eastern limb of the sun, upon which the slit of the spectroscope was directed during the first half of totality, somewhat diminishes my confidence in the conclusion of the text, as to the nature of these three lines. I think it absolutely certain that they do not belong to the spectrum of the *brilliant portion* of the prominences; but the photograph shows, in addition, an extensive nebulosity surrounding the nuclei, with a pretty definite boundary of its own. This nebulosity is best seen in No. 2 of the totality pictures taken at Burlington. Now, it is *possible* that these lines may belong to this *nebulosity*, and not to the *corona proper*; for I cannot recall, with certainty, whether the 1474 line retained its brilliance at any considerable distance from the prominences. My impression is that it did, and that the text is correct, but do not wish to be too positive. The eclipse of December, 1870, will decide, of course.

and the prominences only appear as bright spots. The general shape of the corona is, however, very well given, and the curious appearance of curvature, in some

parts, is very manifest. This and other pictures—if others than the one we have seen were made—may throw some light upon this extraordinary object.

ON RAISING A HIGHER TEMPERATURE IN CERTAIN SOLUTIONS BY STEAM OF 212° FAHR. (100° C.).

By PETER SPENCE, F.C.S.

Some twelve to fifteen years ago, the author had occasion to require large masses of liquor to be raised to a temperature of 228° F. (108·8° C.), for the purpose of extracting, by means of long-continued digestion at that heat, of alumina, in the form of sulphate of alumina, from minerals containing that earth. As time was an element of importance in his calculations, the author's aim was to heat the liquors as rapidly as possible; but lead vessels only could be used with the acid liquors; and, as it was requisite to have an iron outside vessel next the fire, the heating was a tedious operation. To overcome this loss of time, the author fitted up a digesting vessel, so as to raise the heat rapidly to 212° F. (100° C.), by injecting steam from a steam boiler into the mass of liquor; and as soon as he had obtained that temperature, he stopped off the steam, and allowed the external fire to operate alone, so as to raise the additional 16° F. (8·8° C.) required, and to maintain the temperature at 228° F. (108·8° C.), his impression being that, above 212° F. (100° C.), the steam, if kept on, would act as a cooling agent, and prevent the temperature rising. The combined operation was perfectly successful, and went on for some time, acting, as the author supposed, in accordance with his pre-conceived theory; but some circumstances led him, subsequently, to doubt whether it was so. He found that if, inadvertently, both steam and fire were left acting after the higher temperature was obtained, the temperature continued, notwithstanding. Again, when the fire was in a condition, through neglect, in which it was obviously of no use, the author was still astonished to find that, as the apparent result of the steam alone, the temperature was at a satisfactory point. This last observation led the author to test the matter in the laboratory in the following manner:—Being convinced that the high boiling point of his liquors had something to do with the phenomenon, he selected a solution of a salt (nitrate of soda) having a high boiling point—about 250° F. (121·1° C.). The nitrate of soda was placed in a vessel surrounded by a jacket; steam was let into the intervening space, until a temperature of nearly 212° F. (100° C.) was obtained; the steam was then shut off, and an open pipe immersed in the solution, and steam from the same source was thrown directly into the liquor; in a few seconds, the thermometer slowly, but steadily moved, and minute after minute progressed, until it touched 250° F. (121·1° C.). This thoroughly explained the results obtained in the digesting vessel, and became to the author of immense practical value. He discarded the use of fire applied to his vessels, which had not only been tedious and troublesome in operation, but involved a loss of many hundreds of pounds per annum in destruction of apparatus, and used only steam as a vehicle of heat. As a corroboration of the theory, which seems to explain the apparent paradox, the author finds that the temperatures of his solutions are in the exact ratios of their specific gravities, and have no connection with the temperature of the steam, which never exceeds 212° F. (100° C.). The greater the specific gravity of his acid solutions, the higher the boiling-point; and, therefore, whatever the boiling point of the solution in water of any salt, to that point, or nearly, will steam of 212° F. (100° C.) raise it.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 245.)

Next in importance to the possession of a good instrument, is the having a good supply of light and knowing how to make proper use of it. The sources of light available for the microscopist's use have already been described; the ways of utilising the light so obtained, and the instrumental appliances for directing it, form the subject of this chapter.

The natural division of illuminators is into two classes—those which act above the stage of the microscope, and send light down upon an object; and those which are placed below the stage, and send light through it.

Of instruments of the first class, one—the *condensing lens*—is usually supplied with every microscope, however plainly equipped. This lens enables light to be concentrated upon the object on the stage; either a double-convex or a plano-convex lens may be used for this purpose. If the first is employed, no particular attention is required beyond placing it at such a distance above, and on one side of the stage, that the light falls at a suitable angle, and that the object is in or near the focus; should a plano-convex lens be used, its position is of some importance, as, if it is turned the wrong way, its spherical aberration is greatly increased, and, of course, a corresponding amount of light lost. The plano-convex lens, or bull's-eye, when used to concentrate parallel rays—daylight, for instance—or divergent rays, such as those proceeding from a lamp, should always be placed with its convex side turned towards the source of light, as the spherical aberration is then much less than it would be when placed in the contrary direction; if the lens is to be used for rendering parallel the divergent rays of a lamp, then the bull's-eye is to be placed in the opposite position, with its flat side turned to the lamp, and at a distance from the flame equal to its focal length. Parallel rays are required when using some of the illuminating apparatus presently to be described.

Very much may be done with the condensing lens, if skilfully used; especial care is required that it

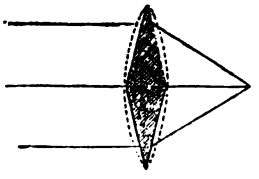
* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

causes the light to fall on the object in the right direction, as the appearance of the surface of many substances is very different when illuminated from opposite sides; the student should, therefore, never be contented with a single observation of a strange substance, but should change its position, so that it may be viewed with the light falling upon it in as many directions as possible. This is most easily effected by causing the object to rotate while the light is directed upon it, so that the alteration caused by every change of position can be easily noted. The necessary movement is now very generally fitted, even to the stages of small instruments, and persons about to procure a microscope would do well to incur the small extra cost of this useful addition.

The light obtained by the condensing lens may be greatly augmented by using two, one of larger dimensions than the other, the light being brought to a certain degree of convergence by the first and larger lens, and afterwards concentrated by passing through the smaller one, which should be so placed as to intercept the cone of light from the large lens at the place where it is of its own diameter.

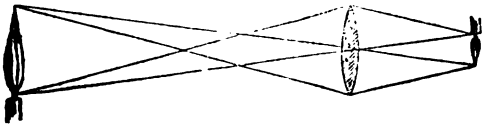
Most of the other illuminators of this class act by reflection, mirrors of various forms being employed. The optical properties of concave mirrors resemble, in many points, those of convex lenses; they cause parallel rays to converge (Fig. 19), render divergent

Fig. 19.



rays parallel, or convergent, and also form images (Fig. 20). Microscopes and telescopes can be con-

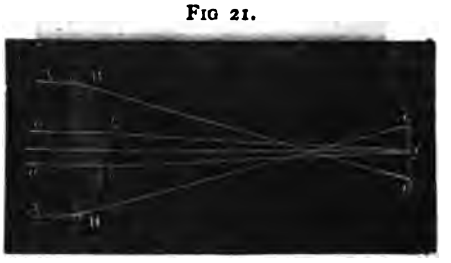
Fig. 20.



structed with mirrors or specula, instead of object-glasses; this principle is still in use as regards telescopes of large dimensions, as the difficulties of making object-glasses of large diameter are very great; the largest yet accomplished is only 25 inches, while the largest speculum (that of the late Lord Rosse) is 6 feet in diameter.

Professor Amici constructed a very efficient compound microscope, having an elliptical speculum in place of an object-glass; the plan, however, was abandoned on the introduction of the achromatic principle, although its performances were very superior to those of the non-achromatic instrument.* Concave mirrors, when formed of segments of spheres, are liable to spherical aberration, just as lenses are (Fig. 21); therefore, when it is required to render divergent rays parallel, or bring parallel rays to a focus, it is necessary that the figure of the mirror should be that of a parabola. Specula of this form are used in astronomical telescopes, the reflectors of lighthouses on the catoptric principle, and in some instruments presently to be described. The parabolic curve differs from the circle principally in being flatter at the edges and deeper at the centre. Reflecting instruments are entirely free

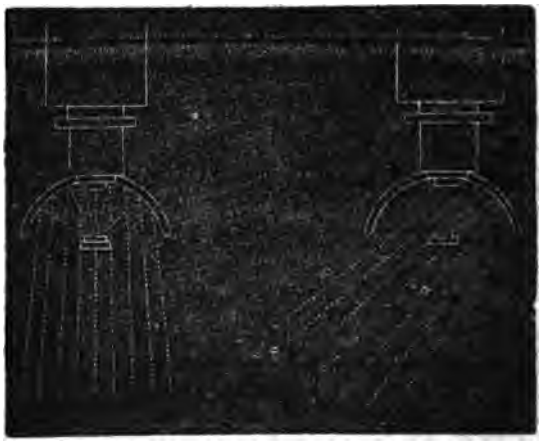
Fig 21.



from chromatic aberration. The oldest of the reflecting illuminators is that known, from the name of its inventor, as the *Lieberkuhn* (Fig. 22); it consists

Fig. 22.

A B



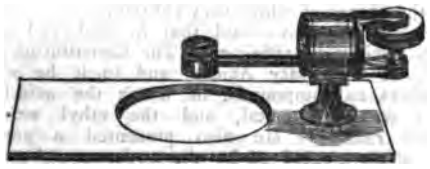
of a spherical silver mirror, perforated, to allow it to slide over the setting of the object-glass, and is so adjusted that the focus of the speculum is coincident with the working distance of the object-glass. The object is illuminated by light reflected through the hole in the stage by means of the mirror; this is again reflected, but in a very convergent state, upon the object, which will be intensely illuminated if the speculum is well adjusted to focus and properly supplied with light.

It is necessary to place beneath the object a black stop of sufficient size to fill the field of the object glass, otherwise the light from beneath entering the microscope will cause a disagreeable amount of fog and indistinctness. The best kind of background consists of a dark well or little cup of proper size painted black inside, and placed below the object; a patch of black paper or paint will, however, answer the purpose. Beck's disc holder (Fig. 23) is particularly useful for objects to be examined by the aid of the lieberkuhn, as it forms its own black stop. Its late talented inventor was very expert in the employment of this kind of illumination. The defects of the lieberkuhn are that its light is nearly vertical, and therefore, like the tropical mid-day

* One of these instruments has recently been presented to the Royal Microspocical Society; there are also several old and curious microscopes in the Society's collection.

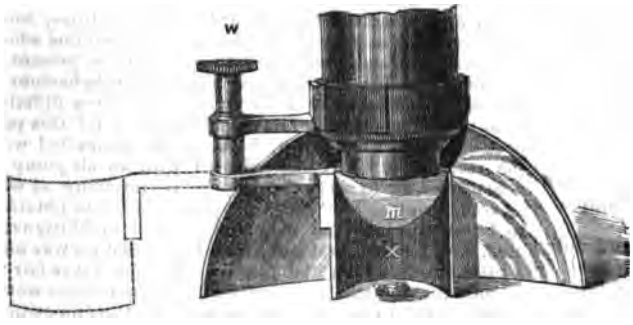
sun, casts little or no shadow; this, however, may be remedied, to some extent, by turning the mirror aside and using the light from only one-half of the speculum (Fig. 22, B); also it requires the object and its mounting to be small enough to allow the free passage of the light around it from the mirror.

FIG. 23.



These defects caused the lieberkuhn to fall somewhat into disuse; the introduction of the binocular microscope, however, caused it again to be employed, as it was found very suitable for the peculiar class of opaque objects which are so well displayed in relief by its stereoscopic power. It has, however, again been nearly superseded by an improved form, which has all its advantages besides some peculiar to itself. This improved instrument, which is known as the *parabolic lieberkuhn* (Fig. 24), is another of the

FIG. 24.



numerous contrivances of the late Richard Beck, and was described by him in the *Microscopical Quarterly Journal* for 1865 (vol. xiii., p. 116). It consists of a portion of a silvered paraboloid, which is attached by a ring to the setting of the object-glass, so that it has some range of adjustment like the ordinary lieberkuhn, but instead of the light being directed upon it from below through the hole in the stage, it is supplied from one side, which allows this form of lieberkuhn to be used with objects mounted in the ordinary way. It is necessary when lamp light is used that the rays should be rendered parallel by placing a condensing lens between the lamp and the reflector, as before-mentioned. As there is a very large reflecting surface, and from the parabolic figure of the mirror no spherical aberration, the amount of light concentrated upon the object is much greater than could be obtained from the ordinary spherical lieberkuhn. It has also the advantage of reflecting rays from one side only and of considerable obliquity. These properties make it the most perfect illuminator yet produced for viewing opaque objects by reflected light. Its effect is almost like that of brilliant sunshine, lighting up the interior of every cavity, and yet, at the same time, casting strong shadows and defining minute portions of structure in a manner hitherto unapproached. The paraboloid as usually constructed is adapted for use with objectives of from 2 inches to ½ focus. A very ingenious mounting, allowing a very large range of adjustment to be given to the paraboloid, has been contrived by Mr. Crouch, who uses a short adapter screwed into the body of the microscope as a support to the reflector and its fittings, which consists of sliding tubes and ball-and-socket joints, by means of which it can be placed in extremely varied positions, and is adapted for use with any microscope or object-glass fitted with the universal screw. It must be borne in mind that these advantages are gained at the expense of removing the object-glass a small distance, viz., the length of the adapter from the Wenham prism, while, to obtain the best possible definition, the back lens of the objective cannot approach the prism too closely; therefore in making choice between the two forms of mounting the paraboloid, the student must consider whether convenience with a trifling loss of definition will suit him, or whether the most perfect definition is required with the trifling inconvenience attending the ordinary form.

An addition to the parabolic lieberkuhn, consisting of a small plane mirror (Fig. 24, *m*) inclined at an angle of 45°, which is so fitted that it can be brought into the proper position for reflecting light vertically upon the object, by means of the milled head, w, has been made by Messrs. Beck, at the suggestion of Mr. Sorby, who required this contrivance for viewing the polished surfaces of specimens of iron and steel. When light is directed obliquely upon a highly polished surface, it is reflected at an angle equal to the angle of incidence, none of it enters the microscope, and the surface appears intensely black, but when illuminated vertically, all its structural peculiarities are at once brought into view. For such researches the plane speculum is indispensable, and its adaptation in no way interferes with the ordinary use of the paraboloid.

The late Richard Beck made a small paraboloid, adapted for use with the 4-10th objective. This the author had an opportunity of working with, and, although only in experimental condition, was much pleased with its performance. It was returned after trial, but has not at present been produced for sale by Messrs. Beck, probably on account of its value not being generally known. From its very short focus, it requires much more careful fitting to the objective it is intended to be used with than the larger paraboloid; but when carefully executed, it works quite as well with its own object-glass as the one above mentioned with the lower powers. The author, however, possesses one which was made for him by Mr. Bailey, of 162, Fenchurch Street, which performs admirably, and is executed in this optician's usual careful manner. The parabolic lieberkuhn is of great value with ½ inch and 4-10th objectives, as these glasses allow but little space between the front glass and the object for illumination with the condensing lens.

A very efficient illuminator was, until recently, much in use; it is known as the *side reflector*, and consists of an oblong silvered mirror of spherical figure. It has ball-and-socket and sliding adjustments, and is attached either to the stand of the microscope or else is mounted upon an independent support; it is placed on one side of the instrument

and the light directed upon it from the opposite side. The speculum is then adjusted until the object is properly illuminated. It has, however, been superseded by the parabolic lieberkuhn before described.

(To be continued).

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 18th, 1869.

Dr. A. W. WILLIAMSON, F.R.S., &c., President, in the Chair.

THE minutes of the previous meeting having been read and confirmed, the following certificates were read:—

For the first time—Samuel Jefferson, Secretary to the Yorkshire Board of Education, Woodville Terrace, Woodhouse Lane, Leeds; Clements Higgins, Demonstrator of Chemistry, King's College, London; James John Bourey, Analytical Chemist, 10, Stepney Causeway, E.

For the second time—Matthew H. Cochrane, 108, Paul Terrace, Glasgow; Edward Smith, Practical and Pharmaceutical Chemist, Strand, Torquay; Thomas Walton, M.R.C.S., and L.S.A., Lecturer on Chemistry at the Hull and East Riding School of Medicine, Kingston-upon-Hull; G. Manley Hopwood, 22, Grosvenor Square, All Saints, Manchester; John Wiggin, Pharmaceutical and Analytical Chemist, Ipswich; Thomas Gibb, A.R.S.M., Engineer; George Harrison, Analytical Chemist, 26, Havelock Square, Sheffield; Sir Roderick Impey Murchison, Bart., F.R.S., Belgrave Square.

For the third time—E. S. Blackwell, Analytical and Consulting Chemist, 6, St. Sacrament Street, Montreal, Canada.

The last-named gentleman was ballotted for and duly elected.

At the request of the President, a paper by William Dittmar, F.R.S.E., and George Cranston, "*On the Formation of Carbonic Ether*," was read by the Secretary.

The authors referred to Ettling's researches upon the action of sodium or potassium on oxalate of ethyl, and had endeavoured to discover the *rationale* of that action. They found that, when ready-formed sodium ethylate (ENaO) is brought into contact with oxalate of ethyl, the former compound, like the metal itself, causes the formation of carbonic ether and carbonic oxide. Dry ethylate (ENaO) was prepared by evaporating the liquid alcoholate in a current of dry hydrogen in a retort heated in an oil-bath, when the compound remained as a white porous mass. On treating dry ethylate with about eight times its weight of oxalic ether, it dissolves, and a yellowish syrup is formed, which sometimes gelatinises on standing. If this mixture is gradually heated, at about 80° C. large quantities of gas (chiefly carbonic oxide) are evolved, and the mass darkens till it is almost black. At 140° the reaction ceases. The mass is then distilled at a temperature not exceeding 200°; and the distillate consists of carbonate of ethyl, sometimes mixed with undecomposed oxalate, and always contaminated with ethylic alcohol. The black residue dissolves in water, and contains oxalate and formiate of soda, and also the soda salts of some complex organic acids. Experiments in order to obtain a basis for the speculation on the nature of the reaction led to the following conclusions:—"ENaO" parts of ethylate, acting upon an excess of oxalic ether, decompose 4 "$(EO)_2C_2O_2$" parts of oxalate of ethyl, and produce 3 "$(EO)_2CO$" parts of carbonate of ethyl, 3 "CO" parts of carbonic oxide, and about 0·4 "EHO" parts of alcohol. The behaviour of dry ethylate of potassium on oxalate of ethyl was qualitatively analogous to that of sodium ethylate; the reaction is, however, more energetic, and begins at a lower temperature.

THE PRESIDENT said they were indebted to the authors for their interesting communication. It was remarkable that those bodies should effect the same decomposition as had been observed with the metals themselves; and he hoped the authors would follow up the reactions, so as to show the phases of which they consisted.

Professor WANKLYN said that he had read a paper to the Society in 1864, on "The Constitution of the Ethers of the Fatty Acids," and in it he regarded the ethers as compounds, in which the acid-forming radical was the metal, and the ethyl oxide the chlorous radical. He also presented a paper on the reaction treated of by the authors, and predicted that ethylate of sodium would decompose oxalic ether, and produce carbonic oxide and a carbonic ether, and that an unlimited quantity of oxalic ether might be decomposed by a given quantity of ethylate of sodium; but the paper was not published by the Society. It was gratifying to him to find his prediction verified so long afterwards by gentlemen who had made the experiment without any communication with, and quite independently of, himself.

"*On the Dissociation of Liquid Sulphuric Acid*," by W. DITTMAR, F.R.S.E., was then read.

In the opinion of the author, the experiments of Marignac on this subject seemed to show that "H_2SO_4" exists as a definite chemical individual only in the solid state, and that H_2SO_4, even at low temperatures, must be regarded as a molecular mixture. To determine which chemical individuals they were to assume to be present in the mixture, Mr. Dittmar investigated the behaviour of the acid H_2SO_4 when boiled under pressures differing from the atmosphere. The apparatus used for this purpose consisted of a retort, hermetically connected with the receiver, which communicated with an air-pump so constructed as to serve the purpose of rarefying as well as condensing. The results proved the residues obtained to be almost identical in composition with Marignac's acid. As the acid first subjected to distillation was only a little stronger than the product obtained, it was fair to assume that a further concentration of the residue would not have led to any further change in its composition. Sulphuric acid, when boiled down under any pressure between 3 c.m. and 314 c.m., behaves almost like a mixture of the stable hydrate $12SO_3 13H_2O$ + excess of SO_3, but the existence of a stable *molecule* of this composition could not be deduced from this fact. The observed facts could be accounted for without denying that in liquid sulphuric acid, even at its boiling point, the majority of the molecules have the composition H_2SO_4. It was known that 'H_2SO_4' vapour consists chiefly of isolated molecules of SO_3 and H_2O; and it was in accordance with Clausius's theory to assume that in liquid sulphuric acid, even at low temperatures, a number of the molecules have assumed the state of motion corresponding to a temperature beyond that of dissociation. The higher the temperature, the greater the ratio of the number of the dissociated molecules to that of the unchanged ones. The liberated H_2O's and SO_3's being formed in the midst of a mass of (H_2SO_4)'s will, probably, mostly unite with comparatively cold molecules of H_2SO_4, and form compounds $H_2SO_4 + H_2O$ and $H_2SO_4 + SO_3$ respectively; supposing the latter compound to be less stable than the former, it is easily understood that, in the distillation of sulphuric acid, the higher the temperature, the more SO_3 will predominate in the vapour.

Professor A. H. CHURCH, M.A., then read a communication on "*Namaqualite*." This mineral occurs in Namaqualand, South Africa, in thin layers of silky fibres, which are true crystals. It is of a pale blue colour; its density is 2·49. Isolated crystals appear transparent under the microscope. In the closed tube it gives off much water, when heated becoming black. The mean per-

centages deduced from the analysis of five specimens are as follows:—

H_2O	.. ..	32·38
CuO	.. ..	44·74
Al_2O_3	.. ..	15·29
CaO	.. ..	2·01
MgO	.. ..	3·42
SiO_2	.. ..	2·25
		100·09

Regarding the silica as an intruding substance, and the lime and magnesia as replacing a small part of the cupric oxide, the author thought the mineral might reasonably be considered as a compound of 4 molecules of cupric hydrate, 1 molecule of aluminium hydrate, and 4 molecules of water. The oxygen ratio between the protoxides, the aluminium oxide, and the water, is 4:3:11 nearly, and corresponds to such a view. The mineral belongs to the rare class of hydrous oxides, in which a protoxide and sesquioxide are united. The fact that it is crystallised, as well as definite and constant in composition, demands for it specific rank.

"*Chemical Researches on New and Rare Cornish Minerals (No. 6)—Hisingerite*," by Prof. Church, M.A. Under this name the author provisionally describes a brown amorphous mineral found in Cornwall. Its chief characteristics are as follows:—Amorphous; reniform; fissured; dark brown; streak, pale; rust, brown (in some specimens, olive-brown); Fragile; fracture, irregular conchoidal; hardness, 2·75; density, 1·74. Before blowpipe in closed tube much water, having faint permanent acid reaction. On charcoal, decrepitates and becomes black. Fuses with difficulty in outer flame to a red brown bead. Boiled in acids leaves a siliceous skeleton.

The mean percentages deduced from three analyses run thus:—

Fe_2O_3	.. ..	52·94
SiO_2	.. ..	36·14
H_2O	.. ..	10·49
		99·57

The mineral also contained 0·82 per cent of P_2O_5 and traces of magnesia.

"*On Chloranil and Bromanil*" (No. II.*), by Dr. Stenhouse, LL.D., F.R.S., &c.

When phenol was acted upon by chloride of iodine in the presence of water, it yielded a brown crystalline mass, from which chloranil was obtained. Red oil, obtained in the ordinary process for preparing chloranil, dissolved in a dilute boiling solution of caustic soda, a sufficient quantity of potassic chlorate, and hydrochloric acid, yielded small crystalline scales, consisting of chloranil and terchlorquinone. When the red oil was digested with nitric acid, sp. gr. 1·36, red fumes took place. Chloropicrin distilled over; chloranil remaining in the retort.

Chloranilic Acid was prepared as follows:—Five parts of chloranil, moistened with alcohol, were added to a cold solution of 6 parts of potassic hydrate in 150 of water; the mixture occasionally stirred till the yellow scales disappeared and part of the potassium salt had crystallised out in dark red needles. The chloranilic salt is precipitated by adding from 10 to 15 parts of chloride of sodium; it is then washed with a solution of common salt, and purified by one or two solutions in boiling water, precipitations by common salt, and a final crystallisation from distilled water. The chloranilate is then dissolved in 100 parts of boiling water, and 10 parts of hydrochloric acid is added; on cooling, the chloranilic acid is deposited.

The alkaline chloranilates are prepared by neutralising pure chloranilic acid with the corresponding alkaline hydrate or carbonate.

Chloranilic ether, $C_6Cl_2(C_2H_5)_2O_4$.—One part of chloranilate of silver is digested with five of ethylic iodide until the silver salt is converted into iodide, the excess of iodide of ethyl distilled off, and the chloranilic ether extracted by boiling alcohol.

The action of chloride of iodine on chloranilic acid gave large transparent plates, which were found to be oxalic acid, and a heavy oily layer, which the author is at present investigating. The author is also investigating the action of bromine on chloranilic acid; he has already obtained a substance corresponding closely to $C_6Br_8Cl_3HO$.

Bromanil.—To prepare this substance, Dr. Stenhouse places bromine in a flask with one-third of its weight of iodine and five times its weight of cold water. On adding phenol through a long digestion tube, a strong reaction takes place; the phenol adhering to the side of the tube is then washed down with five parts more boiling water, and the whole digested for one or two hours at 100° C. When cold, the semi-solid contents are freed from the mother liquor with a Bunsen's vacuum filter, and digested with bisulphide of carbon to remove terbromophenic acid. Tolerably pure bromanil remains.

When bromanil was digested with hydriodic acid and phosphorus, bromhydranil, $C_6Br_4O_2H_2$, was obtained. The author also procured terbromhydroquinone and terbromquinone from the action of sulphurous acid on bromanil.

Bromanilic acid was prepared in a similar manner to chloranilic acid.

Bromanil phenylamid was prepared by adding an excess of aniline to bromanil dissolved in benzol, and washing the almost black crystalline plates with boiling alcohol.

The author concludes with an account of the action of bromine on bromanilic acid.

The President, in thanking Dr. Stenhouse for his interesting communication, referred to the beautiful specimens of some of the compounds described which had been sent to the Society by Dr. Stenhouse.

"*On the Salts of Acetylinated Ethyl*," by J. Alfred Wanklyn.

The liquids having the empirical formulæ $C_6H_{10}O_3$, $C_8H_{14}O_3$, and $C_{10}H_{18}O_3$, respectively, and which were discovered by Geuther, and Frankland and Duppa in the course of their researches on acetic ether, and to which a variety of names have been assigned by their discoverers, have been found to be, in reality, the salts of the new organic radical, "acetylinated ethyl." They show two characteristic reactions—With ethylate of sodium they yield salts of common ethyl, the acetyl being exchanged for hydrogen, thus:—

Butyrate of acetylinated ethyl.

$$\overbrace{\left.\begin{matrix}C_2H_4(C_2H_3O)\\C_4H_7O\end{matrix}\right\}}O + \left\{\begin{matrix}C_2H_4Na\\H\end{matrix}\right\}O = \left\{\begin{matrix}C_2H_5\\C_4H_7O\end{matrix}\right\}O + \left\{\begin{matrix}C_2H_4Na\\C_2H_3O\end{matrix}\right\}O$$

With baryta water, they give alcohol, a ketone, and carbonate of baryta—

$$\begin{matrix}C_2H_4(C_2H_3O)\\C_4H_7O\end{matrix}\Big\}O + \left\{\begin{matrix}Ba\\H_2\end{matrix}\right\}O_2 = \left\{\begin{matrix}C_2H_4H\\H\end{matrix}\right\}O + \left\{\begin{matrix}C_2H_3O\\C_3H_7\end{matrix}\right\} + \left\{\begin{matrix}Ba\\CO\end{matrix}\right\}O_2,$$

wherein H_2 replaces acetyl and butyryl, and the latter do not form acetate and butyrate of baryta, but a ketone and carbonate of baryta, being an example of the common method of producing ketones, but at the temperature of the water-bath instead of at a low red-heat.

The Society then adjourned till Thursday, December 2nd.

We have received the following letter from Professor Wanklyn, respecting his researches on the subject of Messrs. Dittmar and Cranston's memoir:—

* For the author's first paper on this subject, see Chemical News, vol. xvii., p. 189.

To the Editor of the Chemical News.

Sir,—The paper suppressed by the Chemical Society in the year 1864, to which reference was made in the course of the discussion of Mr. Dittmar's admirable research "On the Production of Carbonic Ether," was a short note on that subject, and was intended to form an appendix to my paper "On the Constitution of the Ethers." In this note, I expressed the belief that the production of carbonic ether was due to the action of ethylate of sodium on oxalic ether, and that the reaction would be found to belong to the class of so-called catalytic actions. These predictions were made avowedly in virtue of the general views of the structure of the ethers which were then entertained by me, and were, in my opinion, useful as tests of the validity of those theories, and also as illustrative of their nature and meaning. The authorities of the Society, however, appear to have entertained a different opinion, and, out of a tender regard for my reputation as a chemist, suppressed the note.

On referring to the report in the Chemical News (vol. x., p. 233), I find the following passage at the end of the abstract of my paper on the ethers:—"An explanation of the formation of carbonic ether from oxalic ether was also given." The note itself has, I believe, never been published, but was referred to by me in a paper "On Formic Ether" (see Chemical News, vol. xvii., p. 144).

At that period, I was unprepared for such an exercise of paternal solicitude on the part of the officers of the Society, and took no steps to avoid suppression. In more recent times, I have always been in readiness to resist dictation of this sort, and, though frequent attempts have been made on the part of the Society to suppress papers either of my own or of my former colleagues, have never submitted to the smallest suppression. The practical result has been that which might have been anticipated, viz., the scattering of my papers through different journals; and, if chemists should hereafter complain that what I have written on a given chemical subject is not all of it to be found in the pages of the *Chemical Society's Journal*, but is diffused through the scientific press, the fault lies with the officials of the Society, and not with me.—I am, &c.,

J. Alfred Wanklyn,
Corresponding Member of the Royal Bavarian Academy of Sciences.

London, Nov. 20th, 1869.

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section).

A meeting was held on Monday evening, the 22nd inst., Dr. Wallace, F.R.S.E., Vice-President, in the chair.

The following four gentlemen were elected Members of Council, in room of four who retired by rotation:—James Anderson, Esq., 98, St. Vincent Street; Dr. John Clark, Anderson's University Laboratory; James Couper, Esq., St. Rollox Chemical Works; P. M. Moir, Esq.

Dr. Wallace then made some remarks on the results of his examinations of some waters taken from cisterns in the vicinity of water-closets, in various parts of Glasgow. He stated that the results of his observations, which were made conjointly with Dr. Anderson, went to show that there was not a trace of any gas present which could arise from the decomposition of animal matter. A microscopic examination did not show the presence of any insoluble matters other than ordinary dust.

A new and very different source of danger, however, was revealed by the analyses. It was found that water which had got warm by remaining in pipes which were exposed to warmth, either by proximity to the usual hot-water pipes or otherwise, was frequently contaminated with lead to such an extent as to render the use of the water for dietetic purposes positively dangerous.

NOTICES OF BOOKS.

Outlines of Chemistry, or Brief Notes of Chemical Facts. By William Odling, M.B., F.R.S., Fullerian Professor of Chemistry at the Royal Institution. London: Longmans, Green, and Co. 1870. 8vo.; 468 pp.

This work consists of detail notes of the lectures which Dr. Odling has been in the habit of giving at St. Bartholomew's Hospital during the last seven years; of such notes, in fact, as are now frequently printed separately and distributed among an audience. It is much to be wished that this plan (which, if we remember rightly, was first introduced at the Royal Institution in 1862) was more often followed, as it must perforce give the listener a clearer idea of the lecture than he could otherwise have, while it prevents his attention from being diverted by the writing of notes. A lecture, after all, is chiefly for puposes of demonstration, and experiments are too often lost by the student who is desirous of making full notes; it is, moreover, always essential that numbers and complex formulæ should appear in other forms than as a momentary utterance or on the black-board. This book is virtually a collection of lecture-notes; and the main object of the author was "to furnish the students of St. Bartholomew's with an abstract" of his lectures. Of necessity, such a collection of notes must form "*outlines* of chemistry;" it is as a picture with all the broad details of design introduced, but without the filling-in and finishing. It is not intended to be used by itself, "but as a companion to the teachings of the lecture-room, and as an aid to the appreciation of more complete works, such as Miller's "Elements" and Watts's "Dictionary."

The work is divided into twelve chapters, the first whereof, although introductory, plunges into the middle of things, and treats of the law of volumes, equivalency, heat of combination, and so forth, and of some of the more complex questions of classification. Thus, in the section on "Acids and Salts," we find such paragraphs as the following:—"Mono-, tri-, and penta- equivalency of same perissad element as nitrogen, in different compounds as N'_2O, H_3N''', and $ClH_4\overset{v}{N}$? Di-, tetra-, and hexa- equivalency of same artiad element as sulphur, in Cl_2S'', $Cl_2S'''O$, and $S''''O_2$, and $Cl_2\overset{vi}{S}O_2$, and $\overset{vi}{S}O_3$? Persistency of different equivalent values in double decomposition, as of stannous and stannic salts by lime—

$$Cl_2Sn'' + CaO = Cl_2Ca + Sn''O$$
$$Cl_4Sn'''' + 2CaO = 2Cl_2Ca + Sn''''O_2$$

Theoretical views concerning change of equivalency, real or apparent. Hypo- and hyper- saturated compounds, saturation by one another of two equivalencies of same atom (?)." Useful sections on the "Formula of Water," and on "The Heat of Combination," are found at the end of this chapter.

The second chapter treats of hydrogen and of the halogen elements, and the third of the oxygen elements. In the latter, the sulphur acids are discussed at some length, and the various actions of sulphuric acid on metals, oxides, and salts are illustrated very concisely by five reactions, in which, by the interchange of hydrogen for metal, we have sulphurous acid liberated when the strong acid acts upon metals; hydrogen when the weak acid acts upon more basylous metals; water or sulphydric acid when the acid acts upon oxides or sulphides; water and oxygen when it acts upon peroxides; and acids when it decomposes salts. This sort of classification of the action of one substance upon others of varied composition is of great use in fixing the separate qualities of a chemical substance in the mind of the student. In each case, we have one constant and two variants, but each variant is the type of a class, and thus the changes become grouped within comparatively narrow limits. The system of types and of analogies is carried out to the fullest extent;

on every possible occasion, related substances are compared; such we have in the list of the "oxides of hydrochloric acid, sulphuretted hydrogen, and phosphine" (p. 65). These expressions will appear strange to some of us, but Dr. Odling does not bind himself to any one name; thus H_3PO_4 is both an oxide of phosphine and ortho-phosphoric acid; $HClO_4$ is an oxide of hydrochloric acid and perchloric acid. In the above comparison, they are obviously called oxides of hydrochloric acid, sulphuretted hydrogen, and phosphine, because the compounds are similarly oxygenated, the HCl, H_2S, and H_3P being found in each compound of its respective series.

Chapter 5 treats of the carbon elements, and extends over nearly a hundred pages. To this group belong carbon, silicon, tin, and lead, a grouping which is founded on the tetrad character of these elements, as indicated by their combination with hydrogen, ethyl, fluorine, and chlorine. In the account of silicon, the terms *Siliconides* and *Siliconetted hydrogen* are employed. It is certainly surprising how such a word as "siliciuretted hydrogen" came to be introduced into chemistry, but it was undoubtedly made in agreement with such words as carburetted, sulphuretted, phosphuretted, &c. Nearly the whole of this chapter is devoted to carbon and monocarbon compounds. These are divided into three groups; *viz.*, the methylic typified by H_4C, the formic typified by formic aldehyde, H_2CO'', and the cyanic typified by hydrocyanic acid, HCN'''.

Chapter 6 gives a description of the Sodium Elements—sodium, lithium, silver, potassium, rubidium, cæsium. With these monad metals are considered the triad metals, thallium and gold, "on account of their each forming a series of monad compounds corresponding to those of potassium and silver." The group of magnesium elements consists of calcium, strontium, barium, beryllium, magnesium, zinc, cadmium, and mercury; and these are distinguished by replacing the hydrogen of hydrochloric acid in the proportion of one atom of the metal to two atoms of hydrogen.

The remaining chapters treat of the other groups of metals; to wit, the Tin Elements—aluminium, tin, didymium, thorium, and indium; the Arsenic Elements—titanium, zirconium, cerium, yttrium, erbium, lanthanum, arsenic, antimony, bismuth, vanadium, niobium, and tantalum; the Chromium Elements—chromium, molybdenum, and tungsten; the Iron Elements—manganese, iron, cobalt, nickel, copper, and uranium; and the Platinum Metals—palladium, platinum, rhodium, iridium, ruthenium, and osmium.

One of the most prominent features of this work, as of all Dr. Odling's works, is the constant attempt to classify—to collect together compounds which, however much they may differ in some respects, have at least one cardinal and prominent resemblance; and, in such classifications, he has wisely exercised his judgment in deciding which kind of resemblance shall determine the grouping of diverse bodies. This must ever be a matter of difference of opinion among chemists, although, for the good of the science, it is much to be wished that an universal mode of classification should obtain throughout the chemical world. The section on *Equivalency* in the first chapter treats specially of the modes of classification; the primary hydrides into mono-, di-, tri-, and tetra-hydrides; and so with chlorides, &c. Then the division of the elements into monads, diads, triads, and tetrads, and into artiads and perissads.

The derivation and explanation of terms, and the arguments in favour of the applicability of some in preference to others, is left to more detail works on chemistry; as, also, is any account of manipulation, and of the preparation of the various simple and compound substances described. This is by no means an elementary work. It is best fitted for the teacher and for advanced pupils; to those who are engaged in the delivery of long courses of lectures it will be invaluable. It is eminently methodical and systematic; if chemistry could ever be what Dr. Whewell calls "a classificatory science," Dr. Odling would be the man to make it so. The very nature of this work makes it *staccato* in character; and, since we have gone to music for a word, we may also say it is entirely free from *appogiature*. There is not a word too much; every sentence is sharp, precise, and to the point; it is a *précis* rather than a finished treatise. It reminds us of a map in which the principal cities and towns are introduced, while the villages are omitted. Compared with a detail "handbook" or "cours de chimie," it is as M. Logerot's "Souvenir du Nouveau Paris" compared with Fielding's map of that city.

Dr. Odling does not employ one form of phraseology; he appears, indeed, rather to prefer to vary the names of a substance as much as possible. He uses such names as cupric nitrate and zinc chloride "indifferently and alternatively" with nitrate of copper and chloride of zinc. The fact is, we are not to say of chemical compounds "by their names shall ye know them;" we must be so familiar with their nature and composition that we shall know them under any reasonable designation whatsoever. It is thus with friends; at first the name is the entity; while, on better acquaintance, the individuality of the entity manifests itself, and we know him and remember him for his character and qualities, the name in its first form of significance having of necessity vanished. It is thus, also, we suspect, that Dr. Odling wishes us to treat chemical compounds. Thus viewed, such terms as "oxide of hydrochloric acid," "nitro-marsh-gas," and "hydro-sodium-carbonate," grate less upon the ear than would otherwise be the case: it is familiarity with the compound designated which is to level the barrier of names. If our friend A. B. chooses to change his name to X. Y., he is the same to us, but to a possible future friend, Z., he virtually becomes another being, because Z. knew him not before the change. Similarly, if we are familiar with the composition of the body HCN''', we may call it, "indifferently and alternatively," prussic acid, or hydrocyanic acid, or nitro-marsh-gas, or cyanic hydride; but, to the neophyte, the matter will appear in a very different light. "What's in a name?" Ask the gentleman who whilom bore the name of *Cimex Lectularius*, or that other one (whose name we also prefer to Latinise) who recently wrote to the *Times* complaining of the adverse influence of his name upon his daughter's matrimonial prospects; and no wonder, for he was called *Johannes Curtacola*. Modern chemistry does not allow her children to have fancies of this sort. In all seriousness, our science does contain a marvellous medley of names, derived from the most varied sources—Hebrew, Greek, Latin, Arabic, Spanish, Old High German, and Low Latin, combine to mystify and perplex the student.

Let us now justify our remarks as to the general character and the extreme conciseness of this work by giving one or two extracts taken at random.

"Methene, H_4C, obtainable from methyl alcohol, H_4CO, through intervention of methyl chloride, iodide, &c., by action thereupon of nascent hydrogen; from formic acid, H_2CO_2, by its transmission over ignited baryta; and from disulphide of carbon, CS_2, the sulpho-derivative of carbanhydride, by its joint reaction with sulphuretted hydrogen upon ignited metallic copper."

Again, in the account of the hydrocyanic and cyanic ethers, we find concise, comprehensive statements of the following nature:—

"β-cyanide of methyl unknown. β-cyanide of ethyl made by reaction of cyanide of silver and iodide of ethyl in sealed tubes—$IH_5C_2 + AgCN = AgI + H_5C_2CN$; also by action of chloroform on ethylamine, in presence of potash—$HCl_3C + H_2(H_5C_2)N = 3HCl + H_5C_2.CN$. Resistance of this cyanide to action of alkalies. Its immediate decomposition, with absorption of water, under the influence of acids, into formic acid and ethylamine—

$$H_5C_2.CN + 2H_2O = H_2CO_2 + H_2(H_5C_2)N."$$

Throughout, Dr. Odling has employed names which indicate the relationship of bodies to each other rather than

their absolute composition. "For example," he says, "although I have no doubt whatever that corrosive sublimate is really a dichloride of mercury, there was a time when I was equally certain of its being a monochloride; and, taught by this experience, I now prefer to distinguish it by the name 'mercuric chloride,' and calomel by the name 'mercurous chloride;' whereby I merely imply, what never has been a matter of question, that the ratio of chlorine to mercury is greater in the one compound than in the other." As a consequence of this method, it happens that bodies differently constituted have similarly constructed names; thus CuO. Fe_2O_3, and SnO_2, are cupric, ferric, and stannic oxides respectively. Dr. Odling has carefully avoided the use of any method of graphic notation: "It has," he remarks, "I believe, exerted, and still continues to exert, a most prejudicial influence on the study of chemical science, by making the fanciful sticking together of variously-pronged discs of more importance than the investigation of phenomena." Again, he has not expressed reactions molecularly, because, as he candidly remarks, "In the majority of reactions, I do not myself know what the molecular formulæ of the reagents and products concerned are, and do not think it worth while to make a pretence of knowing."

Now, we have been wont to regard Dr. Odling as the extremest radical in the world of chemists—indeed, as a sort of revolutionary red republican; and we rejoice to find him taking an intermediate course, leaving extreme views to the Raspails and Rocheforts of our science. There is no denying the fact that the science has progressed so rapidly of late that the prominent attitude of chemical thought is generalisation; facts have accumulated in such an astounding manner as the army of workers has increased that the desire of collecting particulars has, in many cases, been replaced by the desire of generalising upon the knowledge already attained. The temptation is, indeed, strong, but the science is not yet ripe for such a process. Certain chemists, seeing a little light in the distance, are hallooing before they are out of the wood. They may spare their voices yet awhile, and had better seek for the path which shall lead others from the gloom hereafter. We pray them to bear in mind Plato's exquisite parable of the dim cave, full of shadows which come and go; and to remember that there are two ways of investigating and discovering truth, to the first of which many have attached themselves. "*Altera a sensu et particularibus advolat ad axiomata maxime generalia atque ex iis principiis eorumque immota veritate judicat et invenit axiomata media. . . Altera a sensu et particularibus excitat axiomata*, ascendendo continenter et gradatim, *ut ultimo loco perveniatur ad maxime generalia; quæ via vera est, sed*" (too often, we fear) "*intentata.*" With a great din of shouting sounding in his ears, Dr. Odling has wisely preferred to reserve his own voice until he is fairly and fully clear of the wood, and we shall gladly trust ourselves to his guidance.

MISCELLANEOUS.

Obituary.—We regret to have to record the death of Dr. Frederick Penny, the Professor of Chemistry in the Andersonian Institution, to which chair he was elected in July, 1839. His published papers and researches, as well as his great success as a teacher of chemistry in Glasgow, testify to his ability as a chemist and physicist; and his loss will be felt by a numerous circle of students and friends.

Operatic Fireworks.—The manner in which scientific discoveries are applied to utilitarian or, at least, to money-making purposes in this material age is well illustrated in a stage effect obtained in the performance of "Faust" at the Grand Opera in Paris. The scene represents *Mephistopheles* in the act of tapping a great wine-vat, whereupon the stream flows like liquid fire, and, falling into the wine-tub, bursts into flame. Usually, the wine stream has been represented by a "squib," but, in the present instance, by very different means. A vessel for containing water was furnished at one side with a horizontal ajutage, and at the other, immediately opposite the ajutage, with an opening closed by a glass plate. The stream issuing from the ajutage, describing a parabola in its course to the tub below, a beam of electric light, directed through the glazed opening and the contents of the vessel, follows the course of the jet from point to point, so that the entire jet becomes luminous and sparkling, the red colour of molten cast-iron being communicated by making the glass through which the light is transmitted to the water of an orange-red tint. The fireworks ignited in the tub to produce the flame previously mentioned are believed to have been set off by pellets of potassium, fired by contact with the water in the manner very generally known. A foreign contemporary suggests that a similar application might be made of the recent discovery by Professor Nickels—that, if commercial chloride of copper be mingled with sulphide of carbon holding phosphorus in solution, the mixture will only smoke, whereas the addition of a little ammonia (either gaseous or aqua ammonia) will insure its instantaneous bursting into flame. It was by means like this that, in the old times, sorcerers wrought their wonders to the astonishment alike of kings and people; but, in these days, the stage-carpenter enables, for a few dimes, miracles to be witnessed for amusement that, a few generations ago, would have filled multitudes with awe.—*American Artisan.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, November 15, 1869.

This number contains the following original memoirs and papers relating to chemistry and allied sciences.

Researches on the Luminous Effects Due to the Action of Light upon Different Bodies—Refrangibility of the Active Rays.—M. Becquerel.—This is the fifth instalment of a lengthy memoir on this subject. In order to study very completely the mode according to which the exciting action (*action excitatrice*) of the solar spectrum is distributed when made to illuminate bodies not possessed of any great phosphorescence, the author applies a wide-mouthed phosphoroscope. The substance to be investigated is reduced to a fine powder, and fixed, by means of a little gum-water, to a plate of mica. The author's experiments led to the following conclusions:—The most refrangible rays, and principally those beyond the violet, are the most active; the different parts of the solar spectrum differ in their activity; the least refrangible rays from the blue, and past the ultra-red, act especially as extinguishers of phosphorescence.

Petroleum in the Netherlands' East Indies.—Dr. von Baumhauer.—The author gives a complete description of a large number of sources of petroleum discovered in different islands of the Indian Archipelago, which are dependencies of the Netherlands. The author states that, from observations and experiments made, there exists, at 250 metres' depth, an almost inexhaustible reservoir of this fluid.

Facts relating to Interverted Sugar.—M. Maumené.—The so-called intefverted sugar is prepared by the author in the following manner:—Perfectly colourless sugar-candy is pulverised and thoroughly washed, first, with pure ether, and then with perfectly pure absolute alcohol; the powder is next dissolved in about five times its weight of very pure distilled water, to which is added 1 c.c. of pure concentrated hydrochloric acid (this quantity of acid is sufficient for the conversion of 1 kilo. of pure sugar). The aqueous solution is heated on a water-bath for a few hours, until colouration just begins to be perceptible. The HCl is removed, by the quantity of oxide of silver required for that purpose, with only five milligrms. excess; the chloride of silver is

separated by filtration; the filtered liquid treated with sulphuretted hydrogen, to make perfectly sure of the removal of all metal; the liquid again filtered, and next evaporated upon a water-bath, yielding perfectly pure glucose. The remainder of this paper is a critical review of M. Dubrunfaut's labours, and too lengthy to admit of any useful abstraction.

Lower Lignites of the Plastic Clay of the Paris Basin.—M. Planté.—An interesting paleontological paper.

Chemical Composition and Mode of Deposition of the Layers of the Great Oolite and Forest Marble in the Haute-Marne.—M. Guignet.—After referring, at some length, to the peculiar geological features of this portion of France, the author communicates the analysis of a peculiar kind of soil, which, in 100 parts, consists of—Silica, 50·0; alumina, 15·0; peroxide of iron, 10·0; lime, 2·5; water, 5·0; magnesia, manganese, sulphuric acid, and other non-determined substances, 17·5; the greater portion of this paper is chiefly of local interest.

Permanganic Acid.—M. Delaurier.—After briefly referring to former communications on this subject, the author states—Manganate of lime is produced by heating, with access of air, 1 equiv. of peroxide of manganese, and 1 equiv. of lime. This compound exhibits a brown colour; and when the ignition is continued, the mixture, being stirred to promote the access of air, it is converted into permanganate of lime, exhibiting a blackish colour, and being more fusible than the manganate—

$$2CaO,MnO_4+O=CaO,Mn_2O_7+CaO.$$

This substance is a powder; and when the author tried to set free permanganic acid from it, by means of 2 equivs. of sulphuric acid diluted with some water, the heat thereby disengaged is too great, and the permanganic acid is decomposed into sesquioxide of manganese and oxygen; but when fused permanganate of lime is applied, the action of the sulphuric acid is slow, and the permanganic acid may be obtained by distillation at a temperature of from 60° to 70°.

This number contains several papers relating to meteorology and luminous meteors—among these, a lengthy account, accompanied with an engraving, of a bolide and its explosion, observed by M. J. Silbermann on the 11th inst., at nearly 11 p.m.

Annalen der Chemie und Pharmacie, October, 1869.

This number contains the following original papers and memoirs:—

Researches on the Essential Oil of the Fruits of Heracleum Spondylium.—M. Zincke.—The essential oil was obtained by distilling, with water, the fruits of the *Heracleum spondylium*. 80 lbs. of the fresh fruits yielded 120 grms. of oil; the water which came over with the oil exhibited a very strongly acid reaction to test paper, and was, therefore, also subjected to investigation. The essential oil which was obtained was of a bright green colour, very fluid, and exhibited only a slight smell, which was rather pleasant; its taste was burning and acrid; sp. gr. at 20°, 0·864; slightly acid reaction to test paper; did not yield, when treated with a concentrated solution of bisulphite of soda, any crystalline substance (stearopten); submitted to fractional distillation, there were obtained two portions—one (about 14 grms.) came over at from 190° to 195°, the other portion (of about 40 grms.) came over at 206° and 208°. This last portion exhibited a perfectly clear neutral fluid, insoluble in water, but miscible with alcohol and ether; sp. gr. at 16°, 0·8717; formula, $C_8H_{10}O$. This portion of the oil turned out to be, on further investigation, an octyl-alcohol; formula, $C_8H_{18}O$. The following derivatives of octyl-alcohol were investigated:—Chloroctyl, $C_8H_{17}Cl$; bromoctyl, $C_8H_{17}Br$; iodoctyl, $C_8H_{17}I$; octylic acid-octyl ether, $C_8H_{17},C_8H_{15}O_2$; benzoic acid-octyl ether, a colourless fluid, exhibiting an aromatic odour, boiling at about 306°, insoluble in water, but readily soluble in alcohol and ether. The investigation of the first portion of the oil (boiling between 190° and 195°) proved it also to contain an octyl-alcohol, but along with it some substances the nature of which could not be ascertained with certainty. The acid-water above alluded to was found to contain acetic and capronic acids.

Synthesis of a Hydrocarbon of Ethyl-Vinyl isomeric with Butylen.—M. Wurtz.—In order to prepare hydrocarbons synthetically, the author causes zinc ethyl to act upon organic bromine or iodine compounds. Zinc ethyl and bromated ethylen are mixed, and heated to 140° in sealed tubes, and next left standing for several weeks. Previous to opening the tubes, these should be placed in freezing mixture, and the gas which is given off when the tubes are opened is made to pass into bromine. The bromated compound thus obtained is a perfectly clear liquid, boiling at 166°; sp. gr., 1·876. When this bromated compound is treated with sodium, ethyl-vinyl is set free; this substance is a fluid boiling at −5°.

Researches on the Constitution of Piperine and its Products of Decomposition. Piperinic Acid and Piperidine.—MM. Fittig and Mielch.—This memoir, of which the first instalment is here given, is divided into the following sections:—1. Preparation and properties of piperinic acid.—This acid is prepared by gently boiling, for about twenty-four hours, a mixture of 1 part of piperine, 1 part of caustic potassa, and 5 parts of alcohol, yielding piperinate of potassa. The authors have tried to split up piperine by means of hydrochloric acid; this method, however, proved unavailable, since there were by-products formed which destroyed nearly all the piperinic acid. Piperinic acid, when pure, is a colourless solid substance, fusing between 212° and 213°; when submitted to distillation along with excess of lime, phenol is among the products of the decomposition. 2. Experiments made in order to solve the question whether piperinic acid contains HO or CH_2O, C_8H_8O, &c.—From the lengthy series of experiments instituted by the authors, the conclusion is that piperinic acid is a monobasic, as well as a monatomic acid. 3. Products of the oxidation of piperinic acid.—(*a*) Behaviour of piperinic acid towards chromic acid. (*b*) Behaviour of piperinic acid with permanganic acid in neutral solution. Piperonal is one of the chief products of the oxidation of piperinic acid; formula of piperonal, $C_8H_6O_3$. Piperonylic acid, $C_8H_6O_4$, stands in the same relation to piperonal as benzoic acid to oil of bitter almonds. (*c*) Action of nascent hydrogen gas upon piperonal and piperonylic acid. (*d*) Piperinic acid and nitric acid. 4. Action of bromine upon piperinic acid. 5. Hydro-piperinic with oxidising substances and bromine.

Researches on the Creosote obtained from Rhenish Beech-Wood Tar.—M. Marasse.—From the introduction to this paper, we learn that there exists some difference between the creosote obtained from beech-wood grown along the Rhine and that grown in a portion of Southern Germany. Both kinds of creosote contain guaiacol, $C_7H_8O_2$, and cresol, $C_8H_{10}O_2$, and, moreover, in addition thereto some other substances not containing oxygen. The author's researches on the Rhenish beech-wood tar prove that there are contained in that liquid—guaiacol, cresol, phenyl-alcohol, and substances homologous therewith. The lengthy essay is divided into the following sections:—(*a*) Researches of the fluids boiling below 199° (the raw material operated on was a rectified creosote of commerce of excellent quality, manufactured by MM. Dietze and Co., operative chemists, at Mainze); (*b*) action of powdered zinc upon creosote boiling between 200° and 203°; (*c*) action of fusing caustic potassa upon creosote of the same boiling point; (*d*) action of hydrochloric and hydriodic acids upon that same creosote; (*e*) preparation of the methylic ether of cresylic alcohol and of the neutral methylic ether of pyrocatechin; (*f*) action of hydriodic acid upon creosote boiling at between 217° and 220°; (*g*) action of hydrochloric acid and chlorate of potassa upon guaiacol; (*h*) action of the last-named chemicals upon creosote boiling at between 200° and 203°. The author of this paper adds a foot-note, of the following purport:—It is generally taken for granted that the use of chromate of lead, in the elementary organic analysis, is preferable to that of oxide of copper whenever the complete combustion of difficultly-combustible substances has to be provided for; but the author found that in the case of cresylic alcohol (even when a current of oxygen is made to pass through the combustion-tube towards the end of the operation), its complete combustion is impossible. As the cause for this phenomenon, the author assigns the fact that a portion of the chromate of lead is entirely reduced to the metallic state, and that this lead retains carbon, preventing its combustion. It is, perhaps, not out of place here to observe that this same observation was made about thirty years ago by the late Berzelius, who therefore advised the admixture of pure and carefully-fused bichromate of potassa in small quantity to the chromate of lead.

Products of the Oxidation of Toluol-Sulpho Acid by Fusing Caustic Potassa.—M. Barth.—The author obtained, by this reaction, paraoxybenzoic acid, salicylic acid, cresol, and other substances. Paraoxybenzoic acid fuses at 210°, and crystallises in prismatic-shaped large white-coloured crystals; formula, $C_7H_6O_3+H_2O$.

Constitution of Phloretinic Acid and Tyrosine.—M. Barth.—When phloretinic acid is submitted to fusion along with excess of caustic potassa, the author obtained a substance, $C_7H_6O_3+H_2O$. On further investigation of this subject, the author came to the conclusion that there exist two acids—

$$C_6H_4\begin{cases}OH\\C_2H_3O_2\end{cases}$$

each of which yields, on becoming oxidised, paraoxybenzoic acid. Tyrosin, when pure, also yields, on fusion with caustic potassa, the same acid. The theoretical reasonings of the author, concerning the constitution of tyrosine—

$$C_6H_3\begin{cases}OH\\NH.C_2H_3\\COOH\end{cases}$$

are too abstruse to be suitable for abstraction.

Decomposition of Acetate of Silver under the Influence of Iodine and a High Temperature.—M. Birnbaum.—After reviewing the labours of MM. Weltzien, St. Claire-Deville, Bourgoin, and others who have experimented on this subject, the author states that he obtained, by causing iodine to act upon acetate of silver, chiefly two substances—viz., a fluid, and a mixture of gas, chiefly carbonic acid; the fluid is acetic acid, while among the gases elayl and acetylen could be readily detected. When the rather violent reaction is moderated, the author found that the following products are formed:—Iodide of silver, acetate of methyl, acetic acid, carbonic acid, acetylen, hydrogen, and sometimes silver and carbon. The quantities of these substances vary considerably, and it is the author's opinion that this should indicate that several reactions are going on at the same time. The reaction may be represented by the following formula:—

$$2CH_3COOAg+I_2=CH_3COOH+CH_2+CO_2+2AgI;$$

$$2CH_2=C_2H_2+H_2.$$

Acetate of silver, when in aqueous solution, behaves with an aqueous solution of iodine in a different manner, and the reaction is expressed by the following formula:—

$$6C_2H_3AgO+6I+3H_2O-6C_2H_4O_2+5AgI+AgIO_3.$$

On Sulphate of Amarine.—M. Groth.—The author first refers to M. Laurent's researches on this subject, and then says that he could only experiment with a very small quantity of the above-named substance, which had been forwarded to him more for crystallographical than for chemical research. Sulphate of amarine is tolerably soluble in water; its water of crystallisation is driven off at about 110°; composition, $2(C_{41}H_{16}N_2)2SO_4+7aq$.

Formation of Phenols when Chloride of Zinc Acts upon Camphor.—M. Rommier.—According to the late M. Gerh-

camphor is converted into cymen and water by distillation with chloride of zinc, according to the formula $C_{20}H_{18}O_2 = C_{20}H_{14} + 2HO$. Very many experimenters—among them, MM. Lippmann, Longuinine, Fittig, &c.—have found it either impossible, or, at least, very difficult, to obtain this result. The author states that he operated with 2 kilos. of camphor, and obtained about 700 grms. of a volatile oil boiling between 140° and 240°; this oil proved to be a mixture of various substances, among which were cresyl-alcohol, several hydrocarbons, and other products of decomposition, due rather to the high temperature than to the simple elimination of water by the chloride of zinc and high temperature together.

Conversion of the Butyric Acid of Fermentation into Normal Primary Butyl-Alcohol, and into Ordinary Butyl-Alcohol as obtained by Fermentation.—M. Linnemann.—This is only a brief preliminary notice written *pour prendre date*.

Cosmos, November 13, 1869.

This periodical contains the following original papers and communications:—

Estimation of Nickeliferous Iron in Meteoric Stones.—M. Meunier.—There are three methods chiefly in use for this purpose—viz., separation of the metal by means of a magnet; solution of the metal in a solvent, which leaves the remainder of the material composing the stone untouched; and the measuring of the hydrogen set free by the solution of the metal in a confined space. The author has added to these methods of estimation another, which he describes as follows:—When the meteorite to be investigated is very finely pulverised in an agate mortar, there is added to it an excess of a solution of chloride of gold in water, the iron (present in the form of minute particles) is rapidly dissolved, and there is formed a precipitate of metallic gold equivalent to the quantity of iron present. The solution of the iron takes place rapidly, so that after a few minutes the operation is complete. The contents of the small flask, wherein the operation took place, are placed on a filter and thoroughly washed with water until the excess of chloride of gold is washed out. When this point has been arrived at, the remainder upon the filter is washed with moderately dilute hydrochloric acid, in order to remove the last traces of any chloride of gold adhering to the stony matter of the meteorite; this having been done, the residue on the filter is removed to a small flask, and therein treated with *aqua regia* (nitro-hydrochloric acid), and the quantity of gold estimated in the liquid by well-known methods. By multiplying the weight of the gold thus obtained by the rapport of the equivalents of gold and iron, that is to say, by—

$$\frac{28}{98{\cdot}18} = 0{\cdot}286$$

the weight of nickeliferous iron is obtained. The author states that he has tested this process, and compared it with the others above alluded to, and found it to yield very correct results.

Quino-Picric Acid.—MM. Duguet and Perret.—A golden-yellow coloured substance, exhibiting a very bitter taste, difficultly soluble in water, but readily in alcohol; also soluble in ammonia and the aqueous solutions of alkalies, without decomposition; not perceptibly acted upon by daylight and air when placed in closed bottles. When projected on burning coals, this substance burns off like lycopodium, but does not detonate; on being ignited on platinum foil, no residue is left if the substance is pure. The composition of this material, which is applied as a febrifuge, is stated to be, in round numbers—Alkaloids, 58; picric acid, 42. It is manufactured by acting with picric acid upon those alkaloids of the *cinchonæ* species (viz., quinidine, quinicine, cinchonine, cinchonicine, &c.), which are not used as medicine by themselves, and, in a sense, valueless.

Annalen der Physik und Chemie, von Poggendorff, No. 10, 1869.

This number contains the following original papers:—

Thermo-Chemical Researches.—M. Thomsen.—This is the second instalment of a lengthy memoir. This portion treats of the hydracids of chlorine, bromine, iodine, fluorine, and cyanogen.

Combinations of Alcohol and Water.—M. Mendelejeff.—The second and concluding part of a very lengthy essay on a subject which is of very great importance, both in a scientific and practical point of view, in consequence of the excise duty on spirits. In this portion of the paper, a chapter is devoted to absolute alcohol. After referring to the discrepancies of the specific gravity of that fluid, as determined by different experimenters, the writer proceeds to state that he has reviewed this subject entirely, taking care to obtain alcohol chemically pure (a far more difficult problem than is generally believed); next, also, avoiding, or, at least, taking into account, the very rapid absorption of water and air (absolute alcohol absorbs air readily—100 volumes of that fluid absorb, at 15°, and 760 m.m. barometer, 10·1 volumes of nitrogen and 6·3 volumes of oxygen). The author found the specific gravity of pure absolute alcohol to be 0·79845 at $\frac{20°}{4°}$ C. In order to dehydrate the alcohol, the following substances were tried:—Potassa, chloride of calcium, dried sulphate of copper, anhydrous oxide of barium, sodium-amalgam, and quicklime; the latter is the substance best suited for that purpose. The paper further contains chapters on the contraction of mixtures of alcohol and water, and on the changes of specific gravity of mixtures of alcohol and water.

New Sulpho-Salts.—M. Schneider.—Sulphide of silver and sulphide of iron, $Ag_2Fe_2S_4$; in 100 parts—Silver, 47·38; iron, 24·56; sulphur, 28·06. This compound exhibits the following properties:—Iron-grey coloured shiny crystalline needles, unaltered in dry air, but becoming rapidly rust-coloured when exposed to moist air; not acted upon by very dilute hydrochloric acid, but becoming rapidly decomposed by the action of stronger acid, sulphuretted hydrogen becoming evolved. Heated in a dry glass tube, this compound fuses, and vapours of sulphur are given off, leaving a residue consisting of protosulphuret of iron and metallic silver. Sulphide of sodium with sulphide of iron, containing water, $Na_2Fe_2S_4 + 4H_2O$; in 100 parts—Sodium, 12·43; iron, 31·07; sulphur, 35·44; water, 19·58. Sulphide of sodium with sulphide of bismuth, $Na_2Bi_2S_4$; in 100 parts—Sodium, 7·79; bismuth, 70·51; sulphur, 21·70. Cuprosulphide of sulphide of potassium with sulphide of copper, $K_2Cu_2S_2$; in 100 parts—Potassium, 10·05; copper, 65·27; sulphur, 24·68. Disodium-cuprosulphide with sulphide of copper, $Na_4Cu_2S_4$; in 100 parts—Sodium, 13·84; copper, 57·29; sulphur, 28·87. Potassic-sulphide of iron with sulphide of copper, $K_2FeCu_2S_4$; in 100 parts—Potassium, 17·28; iron, 12·37; copper, 42·08; sulphur, 28·27. Ferro-sodium-sulphide of copper with sulphide of copper, $Na_2FeCu_2S_4$; in 100 parts—Sodium, 10·94; iron, 13·32; copper, 43·50; sulphur, 31·44.

Emission and Absorption of the Heat-Rays Emitted by Bodies at Lower Temperatures.—M. Magnus.—The main points of this paper are:—Different bodies, heated to 150°, emit different kinds of heat; some substances only emit one kind of heat—others, again, various kinds. Pure rock-salt is monothermic; sylvin (chloride of potassium) behaves in a similar manner.

NOTES AND QUERIES.

Bisulphite of Lime.—(Reply to "A. N. Palmer.")—This substance is made by passing a current of sulphurous acid gas into milk of lime until a clear liquid is obtained and the lime dissolved. Care should be taken to wash the sulphurous acid.

Shoddy.—(Reply to "Child.")—Use nitric acid; this will have the effect you desire, of reducing the woolly substance to a pulpy mass converting it into xantho-proteic acid, which is valuable as manure. By applying the acid named, you can somewhat reduce the quantity of sulphuric acid for dissolving phosphates.

Aluminium Sulphide and Phosphide.—I wish to obtain a small quantity of sulphide and phosphide of aluminium, and should feel greatly obliged if you could inform me where it is probable I could obtain them. I have tried most of the London retail houses, but without success, neither have I been successful in making these compounds, though following the methods described in Watts's "Dictionary," vol. i., rather strictly. Perhaps you could likewise inform me where I could find the processes described in greater detail.—D. H.

The Atomicity of Aluminium.—Would some kind reader oblige an intending candidate for examination by communicating the most rational view of the atomicity of aluminium? Miller classes it as a triad, while Williamson states it to be of "even atomicity;" Roscoe called it tetratomic, but has withdrawn that assertion from his last edition. Messrs. Mottershead profess to follow Roscoe in their chemical labels, but give the symbol for alum $Al(NH_4)_2SO_4 + 12H_2O$; This, I presume, is a misprint (though still remaining uncorrected); but why should the single formula be given, instead of the double one of the books?—Dubitans.

By-Products Containing Soluble Phosphates.—(Answer to "Arthur Warner").—It is not at all likely you will meet with any such by-product, unless, perchance, in the mother liquor of phosphate of soda manufacture; but phosphoric acid is too valuable a substance to be negligently dealt with. There is a method of extracting gelatine and glue from bones, whereby the latter are first treated with a moderately strong hydrochloric acid which dissolves the mineral matter of the bone, and, consequently, contains all the phosphates thereof in soluble state; but where you could obtain such liquor we are unable to say; perhaps glue and size makers would be able to inform you.

MEETINGS FOR THE WEEK.

Monday, 29th.—Medical, 8.
—— London Institution, 4.
Tuesday, 30th.—Royal, 4. Anniversary.
Wednesday, Dec. 1st.—Society of Arts, 8.
—— Pharmaceutical, 8.
Thursday, 2nd.—London Institution, 7.30.
—— Chemical, 8.

TO CORRESPONDENTS.

Tallow Melter.—Please forward your address, as a letter is waiting for you at our office.

E. H. & Co.—You can learn particulars about the automatic steam-boiler feeding apparatus with constant level by writing to M. E. Leroux, 11, Rue des Beaux-Arts à Paris.

An Old and Regular Subscriber.—Address to M. Théodore Péters, fabricant de couleurs d'aniline et d'orseille, Chemnitz, Saxony.

F. Sutton.—Received, with thanks.

Enquirer.—(1) L. Oertling, 27, Moorgate Street, E.C. (2) None but good ventilation.

M.—See Liggeria's process, given in the Chemical News a short time back.

R. R. Tatlock.—Received, with thanks.

THE CHEMICAL NEWS.

VOL. XX. No. 523.

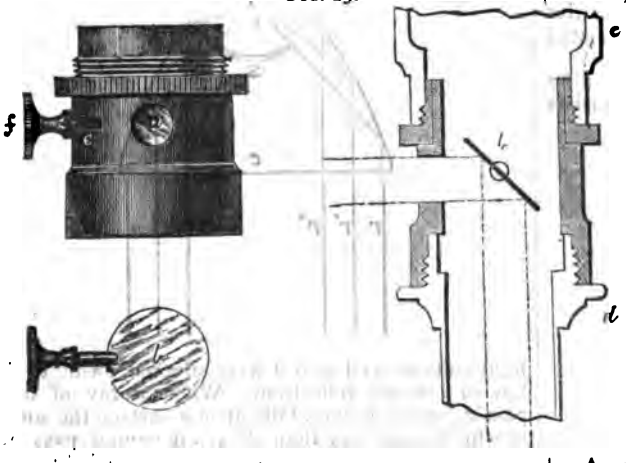
ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 258.)

A MEANS of illumination adapted for use with objectives of high power, in which the space above the object is too small to admit of light being thrown upon it by any of the apparatus just described, has been contrived by Professor H. L. Smith, of Kenyon College, Ohio. He uses the object-glass itself as a condenser. A pencil of light is admitted through an aperture in the side of an adapter screwed on to the body of the microscope, which contains a small silvered mirror with suitable adjustments for reflecting the pencil downwards through the object-glass which is attached below the adapter. This apparatus was sent to Mr. E. G. Lobb, of the Royal Microscopical Society, and exhibited at the meeting in January, 1866. The instrument was placed in the hands of Messrs. R. and J. Beck and Messrs. Powell and Lealand, who each produced an improved modification. For the silvered mirror of Professor Smith they both substituted an unsilvered glass surface; that of Messrs. Powell and Lealand was a piece of parallel surfaced glass, fixed at an angle of 45°; Messrs. Beck used a disc of thin cover glass (Fig. 25, *b*), and allowed the angle to be altered at pleasure by means of a milled head, *f*, passing through the aperture, *e*. The light of a lamp is directed through the hole, *a*, in the adapter, and forms an image of the flame on the object when the object-glass is in focus. The lamp should be placed at a distance of about eight inches from the instrument; sometimes a condensing lens may be placed between the lamp and microscope with advantage. The manipulation with the instruments of both makers is precisely similar. The objects to be viewed with this illuminator should be uncovered, otherwise the cover reflects nearly the whole of the light, and scarcely any falls upon the object; some light is also lost by reflection on its passage upwards through the oblique unsilvered mirror. The impossibility of obtaining a satisfactory view of a covered object will most probably prevent this instrument from coming into very general use, although it affords valuable information to those who will take the trouble to master the difficulties attending its use.

FIG. 25.



The second class of illuminators, those which are placed beneath the stage, are also very numerous. The most familiar is the *mirror*, which forms a part of every microscope. A great variety of illumination may be obtained from the mirror alone, if properly mounted so that it may be turned considerably aside. The mirror of many microscopes is now placed on a double-jointed arm, which permits very oblique illumination to be obtained. In order to understand practically the difference caused by the position of the mirror, the student is recommended to examine a diatom of moderate difficulty, such as *Pleurosigma angulatum*, with a good ½ or ¼ objective, which should be accurately adjusted for the thickness of the cover glass, and a deep eye-piece should be used. It will be found, when the light is central, that none of the usual markings will be visible; but when the illuminating pencil falls very obliquely, the *apparent* cross lines (?) will come into view. With the better class of microscopes, the mirror is usually made double, one side concave and the other plane; the plane mirror is used for reflecting daylight when the greatest intensity is not required, and for use with the achromatic condenser and parabolic reflector (Wenham's), and in all other cases when parallel rays are needed. The concave mirror acts in some degree as a condenser, and is to be used with lamp light and when it is required to make daylight more intense. The *diaphragm plate* is used in combination with the mirror to regulate the angle of the pencil; this can, however, be done with much greater nicety by employing the graduating diaphragm of Mr. Collins (Fig. 26) or the very beautiful iris diaphragm of Messrs. Beck (Fig. 27), both of which allow the aperture under the stage to be gradually diminished or enlarged without the interval of darkness which occurs during the shifting of the ordinary wheel of diaphragms.

A very useful illumination, resembling the light of a *white cloud*, may be obtained by placing a piece of white paper over the mirror, and concentrating the light of a lamp upon it by means of the con-

FIG 26.

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

densing lens: The soft white light so produced is extremely pleasant to use, and suits delicate and transparent objects viewed with the binocular, and will be found of more general service than the full light of the mirror, which, with the double body,

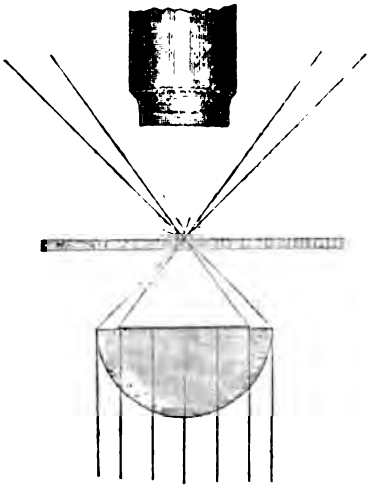
Fig. 27.

often produces a most disagreeable glare, which only obscures and confuses instead of defining.

The mirror affords the simplest means of obtaining what is known as *dark field illumination*, for which we are indebted to the Rev. J. B. Reade, F.R.S., President of the Royal Microscopical Society. His original contrivance consisted of an ordinary condensing lens, so placed with respect to the lamp and the stage, that it transmitted a pencil of such obliquity that none of it entered the object-glass, so that the object alone was lighted, while the field remained dark. The same effect can be produced with the mirror when turned very much aside, and only a low power, such as an inch or ½ objective, is employed. It is a most valuable mode of illumination, and one which the author employs very extensively, as independently of the beautiful effects produced by it when skilfully managed, it enables structural peculiarities to be observed which are not readily demonstrated by other means.

The black field is still more perfectly obtained by the use of the *spotted lens* (Fig. 28). This consists

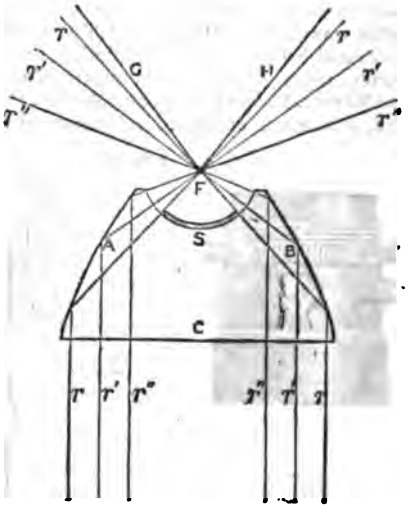
Fig. 28.



of a small bull's-eye, mounted so that it will slide up and down in a fitting beneath the stage to allow of focussing; on the centre of the plane side of the lens is placed an opaque black stop, allowing only the marginal rays to pass. If an object is placed in the focus of the hollow cone of light so transmitted, it will be found, if possessing sufficient opacity, to disperse a portion of the light, to shine brilliantly, and become apparently self-luminous, while, as will be seen by the diagram, the rays, after crossing at the focus, diverge, and do not enter the object-glass, and so leave the field more or less black. The effect is very much that of causing a semitransparent object to appear like an opaque one illuminated by reflected light. *Diatomaceæ*, living aquatic animals and plants, the skeletons of the *Polyzoa*, insect preparations, when not too thin and transparent, and many other objects, are displayed to the greatest advantage by means of black field illumination.

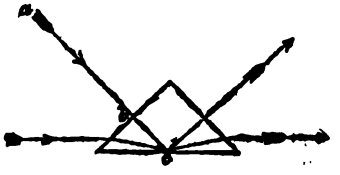
Black field illumination is obtained most perfectly by means of a *paraboloid* placed beneath the stage. Mr. Wenham's first contrivance consisted of a silvered parabolic cup, open at the apex, which reflected parallel rays very obliquely, the access of direct light being prevented by a stop placed in a proper position. The performance of this illuminator was perfect, the only objection to it being that it was rather difficult to keep the reflecting surface bright. This has been remedied by constructing the paraboloid of glass, the illuminator now in use being a solid cast in glass of the original silvered speculum (Fig. 29). It reflects

Fig. 29.



light quite as well as if it were silvered, owing to the law of internal reflection. When a ray of light passing through glass falls upon a surface the angle of which is not less than 38° 41′, it cannot pass out of the glass into air, but is totally reflected (Fig. 30).

Fig. 30.



The ray, *a*, entering the triangular prism at *b*, passes through to *c*, where not being able to pass out into air, it is reflected, as if the surface at *c* were silvered, only far more perfectly, the reflection being total. This principle is made extensive use of in the construction of optical apparatus, a reflecting prism being always preferable when it can be used, on account of its wasting less light than a metallic

speculum or silvered glass mirror. If a tumbler is filled with water, and the surface of the water looked at upwards through the side of the glass, it will be found that the surface of the water will reflect light more brilliantly than the best mirror. The glass paraboloid, although unsilvered, and appearing at first sight to be a lens rather than a mirror, is nevertheless a far more perfect reflector than its metallic predecessor. Parallel rays (Fig. 29, *r*, *r'*, *r''*), falling upon the plane surface, C, at right angles, enter the glass paraboloid without refraction, and, not being able to pass out through its curved sides, A, B, are reflected to the focus, F, and diverge from thence at an angle so great that none of them enter the object-glass. The apex is ground out to a spherical figure, so that the pencil also emerges without refraction. The centre stop, S, is attached to a wire passing through a hole drilled in the block of glass, and furnishes a means of adjustment, so that the least oblique rays can be cut off if required, which is necessary when the paraboloid is used with the higher powers, the stop in that case being pushed up as far as it will go. A well constructed paraboloid is capable of giving a black field with a $\frac{1}{4}$th of 100° of aperture. The paraboloid is superior to the spotted lens on account of its freedom from chromatic and spherical aberration, and also from its larger angle, which is about 127°, while the angle of the spotted lens is a little under 90°. The spotted lens, however, can be used with advantage in examining objects which have a degree of transparency which would prevent their perfect observation with the paraboloid, this latter illuminator being better suited for the examination of semi-opaque or translucent tissues. Black field illumination, like that by reflected light, is perhaps more free from the deceptive appearances which so frequently lead to errors of interpretation, and one or both of these modes of lighting should always be employed when practicable. As the amount of light stopped by the object depends in some degree upon its opacity, the relative density of the various parts may be fairly judged of by their respective brilliancy. Dark field illuminators aid very much in the production of stereoscopic effect, no methods of illumination, saving those by reflected light, giving such correct views of the relative position in depth of the various parts of an object, with an advantage peculiar to themselves of revealing internal structure to a great extent.

(To be continued).

ON THE

CONSTITUTION OF SODIC SULPHATE IN SOLUTION.

By CHARLES TOMLINSON, F.R.S.

I. MODERN HYPOTHESES.

IN the CHEMICAL NEWS (vol. xx., p. 241), you quote, from the *Comptes Rendus* of April 19th, 1869, a note by M. Dubrunfaut, in which he gives credit to M. Löwel for having demonstrated and put in evidence this capital fact —that sodic sulphate, dissolved in water as

$$NaO,SO_3+10HO,$$

is found in solution as NaO,SO_3+7HO. The salt has undergone a molecular change. "We imagine we have dissolved the 10-atom salt; but, in surcharging the solution with an excess of it, we have so modified its composition as to create a new and more soluble compound, capable of producing the strange and mysterious phenomena of supersaturation."

The molecular change which is so clearly made out to this observer is by no means so clear to M. Lecoq de Boisbaudran. In a note to the *Comptes Rendus* of May 3rd, he expresses his opinion that sodic sulphate, in the aqueous solution, is no longer constituted with 7 equivalents of water, any more than with 10, or without any water at all; "but that it may exist under all conditions of hydration, known or unknown, of which the existence is possible." The co-existence of many hydrates in solution is not more difficult of comprehension than the phenomena of dissociation or the equilibrium of ethereal reactions."

In a note in the *Comptes Rendus* for May 10th, M. F. Margueritte denies the justice of M. Dubrunfaut's position as regards the molecular change imputed to alcoholic supersaturated solutions of sugar. He treats the theory as a simple allegation:—"We have hitherto supposed a supersaturated solution to be one in which a liquor dissolves a substance in a proportion which exceeds its normal solubility. The alcoholic solutions of sugar are in this condition; they present the characters of supersaturation, properly so called; and we do not understand the argument of M. Dubrunfaut in opposition to this established fact. . . . As a point of departure, he supposes salts or bodies that present the phenomena of supersaturation to undergo, in dissolving, a modification which augments their solubility; as, when the 10-atom sodic sulphate solution deposits the 7-atom salt, he supposes this to have pre-existed in the solution. In following up this reasoning, we may suppose the salt to exist in three states in the solution, viz., the anhydrous, the 7-atom, and the 10-atom varieties, since we can obtain, at different temperatures, all three. These are simple hypotheses, which cannot resolve the delicate question as to the condition of salts in solution."

On May 24th, a second note appeared from the pen of M. Dubrunfaut. Taking sodic sulphate as the typical salt for the phenomena of supersaturation, he admits that it offers exceptions to the general laws which regulate solubility as a function of the temperature. The investigation is difficult, because the state of supersaturation can be maintained only in close vessels; so that, in seeking to apply physical tests, crystallisation sets in, and the state of supersaturation is at an end. Moreover, these solutions are not obedient to the test of optical rotation. Hence, in interpreting Löwel's hypothesis, M. Lecoq de Boisbaudran has not a more solid stand-point than M. Dubrunfaut. But there can be no doubt that sodic sulphate, in the condition of supersaturation, has lost its primary constitution as a 10-atom salt, since its solubility has increased tenfold at 0° C. It owes this modification to the influence of the water, though heat may regulate the exertion of it.

Now, the 10-atom salt, at 18° C., gives at once, to water, a density of 1120, water being 1000. This is the density of the normal saturated solution.

The mother liquor of a solution saturated at 103°, which, after being supersaturated, is made to deposit the normal salt by disturbing the state of supersaturation, has also a density of about 1120 at 18°. The mother liquor of the crystals formed after saturation at 33° has a similar density.

If the anhydrous salt formed by drying the 10-atom salt be treated with water at 18°, the initial density of the solution is 1157, which, after five or six hours' contact with excess of the salt, rises to 1167. It then falls, and, after twenty-four hours, it becomes 1120 at 18°.

The anhydrous salt vitrified by fusion appears to be a little more soluble under the same conditions, since the initial density of the solution which is 1167 attains the maximum of 1180, but, in twenty-four hours, falls to 1120.

The 7-atom salt cannot, of course, be operated on; but it is known to be less soluble than the anhydrous, and the density of its mother liquor is 1120.

Hence there is only one fixed term of solubility, namely, that given by the 10-atom salt, and represented by 1120 at 18° C. Whatever modifications are produced in the solutions by means of temperature or supersaturation, the mother liquor always returns, after the lapse of sufficient time, to this normal, fixed density of 1120.

In considering the abnormal solubility of the anhydrous salt, whether obtained by drying or fusing the 10-atom variety, and in comparing the amorphous state of this salt with sugars in the state of supersaturation, are we not led to conclude that the molecular constitution of the anhydrous sulphate has the same constitution as that of the sugars in supersaturated solutions?

The depression in temperature which accompanies solution implies a transfer of heat into molecular mechanical work under the conditions of supersaturation. When this state ceases, the temperature rises, implying an inverse transfer of mechanical work into heat, in consequence of the return of the saline molecule to its primary constitution.

The facts of superfusion and supersaturation are well explained by changes in physical and chemical constitution brought about by fusion or solution, the two molecular conditions being, probably, the crystalline and the amorphous.

Such are M. Dubrunfaut's views, which I have endeavoured to give in a condensed form. M. Margueritte replied, on June 7th, that M. Dubrunfaut's hypotheses are contradicted by experiment. Crystallised sugar may form supersaturated solutions in dilute alcohol, and still preserve intact its optical properties, and, therefore, the identity of its constitution, a fact which proves that the increased transitory solubility of a body is not the effect of a molecular change or of an isomeric modification.

The same number of the *Comptes Rendus* contains also a note by M. Lecoq de Boisbaudran, in reply to M. Dubrunfaut. After some remarks on change of structure by means of fusion, which produces modifications similar to those which result from solution, he admits that Löwel's hypothesis rests on facts observed under conditions when supersaturation no longer exists. While not agreeing with M. Dubrunfaut, he does not insist on his own hypothesis; and, although optical tests fail in the case of sodic sulphate, yet an experiment with chrome alum shows the co-existence of two different modifications in a definite state of solution. Dissolve chrome alum in the cold, and the solution has a blue-violet colour; dissolve the same salt in boiling water, and the solution is dark green. If the two solutions be exposed to the ordinary temperature, the blue solution soon loses a little of its purity, and tends to become greenish, while the green solution tends to become bluish, until at length the two solutions pass into the same green-blue colour, which represents the intermediate state between the initial modifications.

M. Lecoq de Boisbaudran cannot understand M. Dubrunfaut's object in undertaking new experiments on the density of the mother liquors of sodic sulphate, since it has long been known that, by exposure to the air, the 10-atom salt is produced from the various solutions, and that, under like conditions of temperature and saturation, the densities must be equal. If M. Dubrunfaut had operated on the anhydrous salt without exposure to the dust of the air, he would have obtained a stronger mother liquor. When a supersaturated solution resting on an excess of the anhydrous salt is suddenly solidified by contact with a crystal of the 10-atom salt, the mother liquor of the anhydrous salt is much richer than the mother liquor of the 10-atom crystals. He believes that the solubilities of all three varieties of the same salt to be equally normal. The solubility of a body ought to be definite under determined physical conditions (temperature, pressure, &c.); but, if such body is in the presence of one of its more stable modifications, this will destroy the initial modification, and we should certainly fall into error in attributing to the primitive body the observed solubility.

M. Dubrunfaut, abandoning the hypothesis which supposes the 10-atom sodic sulphate to exist as the 7-atom in solution, now supposes the anhydrous salt to be in solution. The objections to the opinion that only the 7-atom salt is in solution apply with even more force to the new proposal to make the anhydrous salt play the same part.

Such is the state of the question at the present time among the French chemists whose views are reported by the Academy. The favourite view of supersaturation, both in French as well as English, American, and, I may add, German text-books, is Löwel's—namely that a solution (say of sodic sulphate) saturated at a high temperature, and left to cool in a close or loosely covered vessel, does not actually become supersaturated, but undergoes a molecular change, in which the 10-atom salt becomes the more soluble 7-atom; so that, instead of having a supersaturated solution of the 10-atom salt, we have only a saturated solution of the 7-atom. When, however, under the influence of some mysterious catalytic action, crystallisation is about to set in, the solution suddenly recovers the molecular constitution of the 10-atom salt, as well as its solubility, and the 10-atom salt is thrown down.

All this is very ingenious. The most remarkable circumstance connected with the Löwel hypothesis is that Löwel was himself the first chemist who called it in question. The facts are these:—Löwel's first memoir appeared in 1850; his fifth in 1855; in all of which he maintains the molecular theory above stated in the case of sodic sulphate, and a similar theory with respect to two other salts—viz., the sodic carbonate and the magnesia sulphate. But, in 1857, he published a sixth memoir, in which he strongly inclines to the opinion that, within the limits of a considerable range of temperature, sodic sulphate in solution is in the anhydrous condition. His views will be given in another article.

Highgate, N., November 22nd, 1869.

ON THE

COMBINATIONS OF PHOSPHATE OF LIME AND SULPHUROUS ACID.*

By Dr. B. W. GERLAND, Macclesfield.

PHOSPHATE of lime, in whatever state it may be, readily dissolves in an aqueous solution of sulphurous acid. The solution can be obtained of great strength; thus, from freshly-precipitated tribasic phosphate of lime, a liquor was prepared of 1·3 specific gravity; and, from bone-ash, one of 1·1708 specific gravity. The former contained, in 1000 c.c.—

	grms.
Sulphurous acid	218·38
Sulphuric acid	0·76
Lime	101·79
Phosphoric acid	82·89
	403·76

These figures agree tolerably with the formula—

$$3CaO,PO_5+6SO_2,$$

as the comparison with the calculated table shows—

$3CaO$	84	98·20
PO_5	71·4	82·89
$6SO_2$	192	224·45
		405·54

* Read before the Manchester Literary and Philosophical Society, Nov. 16th, 1869.

The solution of bone-ash in sulphurous acid of 1·1708 specific gravity, was found to contain, in 1000 c.c.,—

	grms.
Sulphurous acid	141·82
Sulphuric acid	trace
Phosphoric acid	47·42
Magnesia	2·79
Lime	59·69
	251·72

The formula $3CaO,PO_5,6SO_2$ requires, for 47·42 PO_5—

	grms.	
Lime	55·78	
Phosphoric acid	47·42	
Sulphurous acid	127·56	
		230·76
The excess of lime in the analysis is		3·91
and magnesia		2·79
These two would require sulphurous acid		8·73
Excess of sulphurous acid		5·58
		251·71

The bone-ash which was left undissolved by the sulphurous acid had lost all its magnesia, a circumstance which accounts for the large amount of magnesia in the liquor.

The proportion of $3CaO,PO_5$ and SO_2 varies according to the strength of the liquor; if the latter is, for instance, 1·060 specific gravity, 5eq SO_2 dissolve $3CaO,PO_5$; and, in still weaker solutions, we find only 4eq SO_2 for $3CaO,PO_5$.

These solutions possess very interesting reactions, some of which are the following.

A neutral solution of ferric chloride precipitates straw-coloured phosphate of iron, and, if added in proper quantity, the liquor is free from both iron and phosphoric acid. The precipitate, after washing and drying over sulphuric acid, is free from lime and sulphurous acid. Its analysis agrees well with the formula Fe_2O_3,PO_5+5HO.

Acetate of copper colours the sulphurous acid solution, when added in small quantity, intensely green; a further addition produces a thick yellow precipitate, which rapidly changes in contact with air, and thereby becomes green. Acetate of lead also produces a thick precipitate of white colour. These precipitates contain, besides the metallic oxide, lime, phosphoric and sulphurous acids. Chloride of barium precipitates the solution directly, and chloride of magnesium after some standing.

The solution of phosphate of lime in sulphurous acid possesses the taste and smell of the acid, but to a much smaller extent than an aqueous solution of the acid containing the same amount of sulphurous acid.

Under the influence of boiling heat, the phosphate solution is decomposed slowly, sulphurous acid escapes, and a heavy white crystalline precipitate is formed. Under the microscope, it appears as composed of crystals of the hexagonal system, like those of rock-crystal. Washed and dried over sulphuric acid, it contained—

Sulphurous acid	15·61
Sulphuric acid	0·23
Lime	39·89
Phosphoric acid	34·48
Water	9·08
	99·29

These numbers agree with the formula—

$$3CaO,PO_5,SO_2,2HO,$$

the calculated numbers of which are—

SO_2	32		15·58
$3CaO$	84		40·89
PO_5	71·4		34·76
$2HO$	18		8·77
	205·4		100·00

This sulphited phosphate of lime has no smell or taste, and is distinguished from all sulphites by its stability. Heated in an air-bath for three hours to 130° C., it lost 0·64 per cent of water; but the amount of sulphurous acid remained unchanged, neither had a humid atmosphere the slightest effect upon it. The water is held in intimate combination, and is only expelled at a higher temperature when it is accompanied by fumes of sulphur, sulphuric and sulphurous acids. The residue contains, besides lime and phosphoric acid, sulphate and sulphide of calcium.

Cold water has no effect upon the sulphited phosphate of lime. After long-continued boiling, the air being excluded, a partial decomposition takes place, which is shown by the following analysis.

1000 c.c. of the water contained—

	grm.
SO_2	0·2680
SO_3	0·0470
PO_5	0·1181
CaO	0·2045

And an undetermined quantity of the undissolved residue contained—

SO_2	0·03464
PO_5	0·12303
CaO	0·13916

The constituents are, therefore, in the following proportions:—

In the solution—

1 eq. PO_5 : 4·35 eq. CaO : 5·07 eq. SO_2 ; 0·71 eq. SO_3;

And in the residue—

1 eq. PO_5 : 2·85 eq. CaO : 0·623 eq. SO_2.

The sulphite, which withstands the action of the atmosphere indefinitely, is rapidly oxidised when incorporated with soil. A quantity was buried in a heavy clay soil (which, as was ascertained previously, contained no lime and phosphoric acid soluble in dilute hydrochloric acid), and was exhumed after two months, when it was found to be free from sulphurous acid. The sample was selected for analysis with the least possible quantity of soil. It contained—

	per cent.
SO_3	18·59
PO_5	24·58
CaO	33·66

The oxidising process which has taken place in this instance may be expressed by the formula—

$$3CaO,PO_5,SO_2,2HO+O=2CaO,HO,PO_5+CaO,SO_3+HO.$$

The original substance contained 34·5 per cent PO_5 and 15·8 per cent sulphurous acid, equal to 19·75 per cent SO_3. The sample for the last analysis ought, therefore, to contain, for 24·58 per cent PO_5, 14 per cent SO_3; but, according to the analysis, it contains 18·59 per cent—that is, 4¼ per cent more. This excess of sulphuric acid proves that it is dissolved at a slower rate than the phosphoric acid. Calculating the amount of lime which the acids of the analysis require, we find, for—

18·59 SO_3 as CaO,SO_3	13·01	per cent CaO,
And for—		
24·58 per cent PO_5 as $2CaO,PO_5$	19·28	,, ,,
Total	32·29	,,

This number is less than the quantity of CaO found by 1·37 per cent, which excess is to be accounted for by the tendencies of the dibasic phosphate to undergo a partial decomposition under the action of water, in consequence of which a compound of higher basicity is left undissolved.

It is, therefore, evident that the new compound will, in the soil, act as a soluble phosphate of lime; it has, in fact, for several seasons been used as a manure, and has given great satisfaction.

'Strong mineral acids dissolve the sulphited phosphate of lime under effervescence of sulphurous acid. Acetic acid has no effect in the cold, and dissolves it only after long-continued boiling, but much easier when the air has access. Oxalic acid decomposes it a little quicker. Chlorine gas is readily absorbed by the new phosphate. After the action is completed, it contains no more sulphurous acid, but only traces of sulphuric acid. Of the phosphoric acid, only a small portion has become soluble (about 1·12th), This decomposition still occupies my attention.

A weak solution of iodine, such as Mohr's standard solution, acts readily upon the sulphited phosphate of lime, as represented by the formula—

$$3CaO,PO_5,SO_2,2HO+I=CaO,2HO,PO_5+CaO,SO_3+CaI.$$

The colour of the iodine disappears as long as there is substance left undissolved. This is a convenient method for estimating the sulphurous acid of the compound; but, as the last portions are only slowly acted upon by the iodine, it is advisable, in order to save time, to add a drop of hydrochloric acid, when the iodine begins to disappear slowly: it does not interfere with the accuracy of the experiment.

The sulphited phosphate of lime, exposed to an atmosphere containing ammonia, rapidly absorbs the latter, but, at the same time, an equivalent quantity of sulphurous acid seems to be oxidised. A sample of the substance was placed under a glass shade with pieces of carbonate of ammonia and water for four weeks, and subsequently over sulphuric acid for two days, and yielded, by analysis, the following results:—

	per cent.
Lime	39·08
Sulphurous acid	2·50
Ammonia	5·60

The new sulphite possesses remarkable antiseptic and disinfecting powers, and, on this account, will command a general interest. The efficacy of sulphurous acid as a disinfectant is well known, and it would be more appreciated if it could be conveniently applied. The aqueous solution is expensive by transport; it is very changeable, and, in many cases, it is unavailable, on account of its pungent smell, whilst, for medical purposes, it can only be used in exceptional cases, in consequence of its irritating action. The sulphites are still more changeable. Exposed to the air, they are acted upon by carbonic acid and by oxygen; and, when mixed with decaying organic matter for disinfecting purposes, they very often increase the mischief, and sometimes cause an abundant escape of sulphuretted hydrogen. The compound of phosphate of lime with sulphurous acid has none of these disadvantages. Acids, as well as ammonia, are neutralised by it. From a sanitary point of view, ammonia is particularly objectionable: being a product of putridity, it helps to accelerate it, and also serves as a vehicle for disseminating other products which, without it, would not be volatile, or only so to a less degree.

The sulphited phosphate, when applied to putrid matter, will probably do its first service by neutralising the ammonia present (including compound ammonias), and also prevent its further formation, as the test-paper will show. The smell will soon cease, or, at least, be greatly diminished and altered, and the mass will be safe for a long time, so that it may be removed or dried without danger or inconvenience. I must here remark that large quantities of putrid matter in open spaces are more completely and speedily disinfected by small portions of the phosphate than samples in glass bottles. The compound recommends itself as a disinfectant by its physical properties. It is a clean white powder, which stains and soils nothing, dusts off garments or carpets, leaving no mark; it is free from smell and taste, and harmless to animal life.

It proves itself invaluable in stables and shippons. The air of these localities is generally highly charged with ammonia, yet the tenants are expected to live and thrive. A regular application of a small quantity of the phosphate will prevent the loss of ammonia, it will sweeten the air, and enrich the manure with phosphoric acid, thus being of threefold advantage. The loss of ammonia from the dung is not inconsiderable; it is also the most valuable constituent of it, being worth more than 9d. per lb. to the farmer.

The solution of phosphate of lime in sulphurous acid also possesses disinfecting powers, and acts, in many cases, even with greater energy than the powder. It might be used with advantage as being applicable to places which could not be reached by the other.

The neutrality, regularity of composition, utter harmlessness, and freedom from smell and taste, recommend the sulphited phosphate of lime for trial in therapeutics. It would be of interest to investigate it in relation to putrid puerperal fevers, pyæmia, &c.

It appeared to me not unlikely that a compound of phosphate of lime with 2 eq. sulphurous acid might exist. Numerous experiments, made with a view of preparing the same, have entirely failed; but some of the results are interesting as showing unexpected reactions of these compounds.

The sulphite of phosphate of lime is not acted upon by the solution of phosphate of lime in sulphurous acid. Sulphurous acid gas is only absorbed in very small proportion by either dry or wet bone-ash. This phosphate of lime is not even converted into the sulphurous acid compound by digestion with the sulphurous acid solution. If sulphurous gas is passed through water holding an excess of phosphate of lime in suspension, the latter remains unchanged.

Under the receiver of an air-pump, the sulphurous acid solution forms good sized crystals, probably belonging to the hexagonal system. Analyses of crystals of different preparations gave varying results, which, however, agreed tolerably with the formula—

$$x(3CaO,PO_5,SO_2,2HO)+y(CaO,SO_2,2HO)+z(CaO,SO_3+5HO).$$

The more crystals separate from the solution, the more the phosphoric acid accumulates in the latter. In one instance, lime, phosphoric acid, and sulphurous acid were almost in proportion of their equivalents.

Alcohol precipitates the solution of phosphate of lime in sulphurous acid. The analysis of the precipitate gave 24·8 per cent of water, and no more sulphurous acid, in proportion to lime, than the above-described powder.

The solution is also precipitated by a current of an indifferent gas, like hydrogen. The analysis of the precipitate gave figures from which no simple formula can be calculated. The amount of phosphoric acid, in proportion to the lime, is greater than that corresponding to tribasic phosphate; and the amount of sulphurous acid is much less than that of the precipitate obtained by boiling. In acordance with the foregoing, the solution, after treatment with hydrogen gas, was found to contain less phosphoric acid, in proportion to the lime, than before.

Under reduced pressure, the phosphate solution boils easier, and the separation of the precipitate takes place more readily. This precipitate contains less sulphurous acid and more water than corresponds to the formula $3CaO,PO_5,SO_2,2HO$.

I experienced so much difficulty in preparing pure tribasic phosphate of lime, that I was obliged to use, for most of my experiments, the phosphate offered by nature in bones and bone-ash.

The compounds of phosphate of lime with sulphurous acid undoubtedly possess great scientific interest. This consideration, as well as the importance they are likely to attain for agricultural and sanitary purposes, as they have now become articles of commerce, has induced me to lay before you the results obtained so far in my investigation, with the prosecution of which I am still occupied.

THE COMMITTEE OF THE BRITISH ASSOCIATION ON THE TREATMENT AND UTILISATION OF SEWAGE.

The following letter has been issued by the above committee to the municipal and sewer authorities throughout the country:—

I have the honour to inform you that, last year, at the meeting of the British Association, at Norwich, a committee was appointed to report on the treatment and utilisation of sewage. In the first instance, a grant of £10 was placed at the disposal of the committee, with which to defray the cost of printing and postage incidental to the collection of preliminary statistical information. Through the kindness of Her Majesty's Government, the committee was enabled to obtain reports respecting the methods of dealing with town refuse practised in most civilised countries; and that information has now been collected in a more complete form than hitherto existed in any country.

This preliminary work being completed, the committee was re-appointed at the meeting of the British Association this year, at Exeter; and the inquiry was considered to present such important features of social and scientific interest, that the sum of £50 was voted towards enabling the committee to enter more fully and practically upon the investigation of this subject. The British Association, being a purely scientific body, has not at its disposal funds which would be adequate or applicable for the full prosecution of this very large and pressingly-important inquiry. The committee, nevertheless, desires to take advantage of the opportunity created by the British Association to investigate the entire subject in all its bearings—whether chemical, physiological, or engineering, sanitary, municipal, or agricultural—and in a manner worthy of the body they represent.

It is unnecessary to point out the enormous importance, especially at the present time, of a full and complete investigation of this question by the light of the knowledge and experience now gained in the several departments above alluded to. But, properly to carry out such an inquiry with a practical end, numerous observations, gaugings, and experiments, aided by simultaneous analyses, are essential; and these cannot be accomplished (especially the analyses) without the continued aid of efficient and, therefore, highly-paid assistants. Moreover, from time to time, it may be necessary for the committee to purchase expensive apparatus, and to subject various inventions and processes to a thorough and complete test; for it is the desire of the committee, not only to ascertain, as far as possible, the causes of the sanitary inefficiency of existing works, but also to inquire into every suggestion which affords promise of practical utility, in order that this investigation may be searching, the report practical, and any recommendations that may be made authoritative.

It is the wish of the several members of the committee to devote, to the utmost of their ability, their personal attention to the work thus sketched out; but the expenses absolutely necessary to enable them to conduct so extended an inquiry cannot but be very heavy, and, unless they are able to secure an adequate fund, they must abandon the attempt to investigate the subject in this broad and comprehensive manner. However, since there is no subject of greater practical and social importance to the public generally, and thus to the various municipal authorities and other governing bodies throughout the country, it is believed that many will share the opinion expressed at the recent meeting of the British Association, at Exeter—that the existence of this committee affords a specially favourable opportunity for such a wide inquiry; and, for that reason, its members confidently appeal to those authorities who are officially interested in the subject to supply the funds necessary for the investigation.

I am, therefore, desired to request that you will kindly submit this letter to the body you represent; and I venture to hope you will give the committee the benefit of your good offices in procuring a subscription proportionate to the population of your town or district. . . .

I am, &c.,

GEORGE F. BARNES,
Honorary Secretary, *pro tem.*

22, Whitehall Place, London, S.W.,
November 18th, 1869.

CHLORINE AND METALLIC SODIUM.

By J. ALFRED WANKLYN, F.C.S.

When chlorine gas is passed over metallic sodium—even when the metal is fused, and, whilst in a state of fusion, shaken in contact with the gas, so as to expose fresh metallic surface—there is no action. A glass vessel containing a piece of sodium was weighed; and, after the transmission of chlorine under the circumstances above named, it was re-weighed.

	grms.
Weight before the action of chlorine ..	7·847
Weight after the action of chlorine	7·863
Gain	0·016

The quantity of metallic sodium taken for the experiment was 0·770 grm.

SPECTROSCOPIC NOTES.*

By Professor C. A. YOUNG, of Dartmouth College.

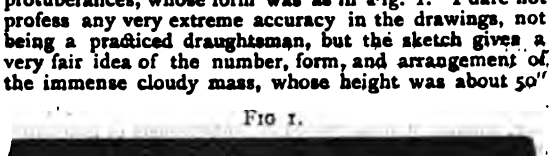
September 4th, 1869.—Prominences were noted on the sun's limb at 3 p.m. to-day in the following positions, angles reckoned from North point to the East:—

1. +70° to +100°, very straggling, not very bright.
2. −10°, large and diffuse.
3. −90°, small, but pretty bright.

September 13th, 1869.—The following protuberances were noted this p.m.

1. Between +80° and +110°, a long straggling range of protuberances, whose form was as in Fig. 1. I dare not profess any very extreme accuracy in the drawings, not being a practiced draughtsman, but the sketch gives a very fair idea of the number, form, and arrangement of the immense cloudy mass, whose height was about 50″

Fig 1.



and its length 330″ (22,500 miles by 1,350,000). The points *a* and *b* were very bright.

2. +135° small, but very bright at the base, of this form (Fig. 2.)

3. −85° of this form (Fig. 3.).

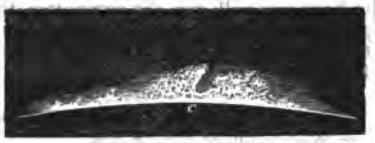
The dark spot, marked *c*, was very curious, reminding one strongly of the so-called fish-mouth in the nebula of Orion. I saw no change in it for 20 minutes. On the

* From the October number of the *Journal of the Franklin Institute*. Kindly communicated, with the cuts, by Professor Morton.

other hand, the first series mentioned were changing rapidly, so that at five o'clock the sketch which was drawn

Fig. 2.

Fig. 3.



at two was quite inapplicable, only the general features remaining unaltered.

4. −128°, about 20″ high, forked, thus :—

Fig. 4

The structure was *cirrus* in every one but No. 3, which seemed more like a mass of cumulus.

To-day, for the first time, I saw b_1 reversed in the chromosphere when the slit was tangent to disc ; 1474 was easy ; the new line at 2602 cannot be detected as yet.

At 2.25, while examining the spectrum of a large group of spots near the sun's western limb, my attention was drawn to a peculiar double *knobbiness* of the F line (on the sun's disc, not at the edge), represented by Fig. 5, *a*, at the point *e*. In a very few moments a brilliant spot replaced the knobs, not merely interrupting and reversing the dark line, but blazing like a star near the horizon, only with blue instead of red light ; it remained for about two minutes, disappearing, unfortunately, while I was ex-

Fig. 5.

amining the sun's image upon the graduated screen at the slit, in order to fix its position which was at −82½, about 43″ from the edge of the limb, about 15″ inside of the inner edge of the spot-cluster. I do not know, therefore, whether it disappeared instantaneously or gradually, but presume the latter. Fig. 5, *b*, attempts to give an idea of the appearance. When I returned to the eye-piece, I saw what is represented at Fig. 5, *c*, &c. On the upper (more refrangible) edge of F, there seemed to hang a little black mote, making a *barb*, whose point reached nearly to the faint iron line just above F. As given on Angström's atlas, the wave-length of F is 486·07, while that of the iron line referred to is 485·92 (the units being millionths of a millimetre). This shows an absolute change of 0·15 in the wave-length, or a fraction of its whole amount, represented by the decimal 0·00030, and would indicate an advancing velocity of about 55·5 miles per second in the mass of hydrogen whose absorption produced this barbed displacement.

The barb continued visible for about five minutes, gradually resolving itself into three small lumps, one on the upper and two on the lower line, Fig. 5, *d*. In about ten minutes more, the F line resumed its usual appearance. I did not examine the c line, as I did not wish to disturb the adjustments and risk losing some of the curious changes going on under my eye.

After the close of this strange phenomenon, I examined, with our large telescope of 6-inch aperture, the neighbourhood in which this took place, and found a very small spot exceedingly close to, if not actually *at*, the place. This was at 2.45. At 5.30 it had grown considerably.

Undoubtedly, the phenomenon seen was the same referred to by Mr. Lockyer, when he speaks of often seeing the bright lines of the prominences not only at the sun's limb but on his disc. It is the only time I have had the good fortune to see it as yet.

The common fire-fly gives a continuous spectrum without any trace of lines, either bright or dark. It is noteworthy that this spectrum lies almost entirely between the lines C and F, the portion of the luminous diaphason where the thermal and actinic effects are nearly *nil*, and where almost all the energy expended is effective as pure light. How different from our artificial modes, in which not more than one-tenth of one per cent of the expended energy appears as light, the rest being mostly wasted in heat, and partly in actinism.

Hanover, N. H.
September 18th, 1869.

CORRESPONDENCE.

THE ATOMIC THEORY.

To the Editor of the Chemical News.

Sir,—Is it not surprising that, during the recent discussion on Professor Williamson's admirable paper on "The Atomic Theory," no one should have hit upon the simple link which unites the opposing doctrines?

Modern chemistry teaches us that the existence of matter as atoms and molecules is pretty nearly as certain as the existence of matter itself. It is only since that conception has been fully adopted, and by means of it, that chemistry has been raised into an exact science; and the idea involves the indivisibility of the ultimate atom.

On the other hand, mathematical science proves that such a thing as an indivisible atom having size and weight is simply an impossibility; and therefore people fear to accept the theory as absolute truth, but are compelled to use it grudgingly as a temporary expedient.

But why? both sides are correct. The atoms are the ultimate forms of matter *as we know it*, in the form of chemical elements; they cannot be divided, and remain those elements. But no one can affirm, or would think of doing so, that these elements are positively the ultimate forms of matter itself. On the other hand, there is a general feeling, justified by the remarkable relations between the atomic weights and properties of elements, that they are very probably compounds of yet simpler forms of matter, though their decomposition may not be possible to man. The doctrine of atomicity, showing us several centres of force in each atom, confirms this.

Hence, although the chemist can only deal with ascertained facts as a chemist, yet he loses none of his rights to the teachings of mathematics, and is quite entitled to believe that matter may be infinitely divisible and non-atomic in its ultimate essence, and yet be atomic and indivisible in the forms in which he has to deal with it.

May not the interplanetary ether be this ultimate form, and the tremendous actions of the sun, with its vast masses of hydrogen, be a stage of resolution of ordinary elements into this form, to be driven into space, and again condensed into ordinary matter, thus keeping up that circulation of existence which seems to be the fundamental system of Nature?—I am, &c.,

John T. Sprague.

MISCELLANEOUS.

The Royal Society.—The annual meeting of the Fellows of this Society was held on the 30th ult., at Burlington House. The President, Lieut.-General Sir Edward Sabine, K.C.B., &c., delivered the inaugural address, in which he reviewed the progress which had been made in science during the year. The following gentlemen were afterwards elected on the Council for the ensuing year, viz.:—President—Lieut.-General Sir E. Sabine, R.A., K.C.B., D.C.L., LL.D. Treasurer—William A. Miller, M.D., D.C.L., LL.D. Secretaries—William Sharpey, M.D., LL.D.; George G. Stokes, Esq., M.A., D.C.L., LL.D. Foreign Secretary—Professor William Hallows Miller, M.A., LL.D. Other members of the Council—Frederick Currey, M.A.; Warren de la Rue, Ph.D.; Sir Philip de Malpas Grey Egerton, Bart., M.P.; Professor W. H. Flower, F.R.C.S.: William Huggins; John Gwyn Jeffreys; John Marshall, F.R.C.S.; Augustus Matthiessen, Ph.D.; Capt. Richards, R.N.; the Marquis of Salisbury, M.A.; C. W. Siemens; John Simon, F.R.C.S.; Archibald Smith, M.A.; Professor H. J. Stephen Smith, M.A.; Professor John Tyndall, LL.D.; and Professor A. W. Williamson, Ph.D. The Copley Medal was awarded to M. Victor Regnault, for his researches on the specific heat of gases and vapours, &c. A Royal Medal was awarded to Sir Thomas Maclear, the Astronomer-Royal at the Cape of Good Hope, for his measurement of an arc of the meridian. A Royal Medal was also awarded to Dr. Augustus Matthiessen, F.R.S., for his researches on the electrical and other physical properties of metals and their alloys. In the course of his remarks, the President said that Dr. Matthiessen's researches were distinguished, as well for their diversity as for their uniformly complete and trustworthy character, and referred, amongst others, to his investigation of the electric conducting power of commercial copper, which had resulted in very great improvement of the conducting power of the copper wire used in submarine telegraphy. After the meeting, the Fellows and their friends dined together at Willis's Rooms. The senior Fellow of the Royal Society is Sir John F. W. Herschel, Bart., D.C.L., who was First Wrangler and Smith's Prizeman at Cambridge in 1813, and was elected F.R.S. in the same year, being then only twenty-three years of age.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, November 22, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Spectrum of the Planet Neptune, and some Observations on Spectrum Analysis.—Rev. Father Secchi, S.J.—The author first refers briefly to his former observations of the spectrum exhibited by Uranus, and then mainly states that the spectrum of Neptune consists chiefly of three lines, or bands, placed near the green line, and that its light is entirely devoid of red; this is confirmed by the colour exhibited by the planet when seen through a telescope, which is a sea-green. The same author states that, though the night of the 14th of November last, at Rome, was not very favourable for observation of asteroids, on account of the somewhat cloudy sky, he had been enabled to notice more than 180 asteroids during one hour.

Heat given off by the Moon's Rays.—M. Zantedeschi.—From this paper, which is chiefly a review of what has been done by this and other authors in this direction, we learn that, as far back as the years 1685 and 1781, the Italian *savants*, Geminiano, Montanari, and Paolo Frisi, proved the existence of rays of heat emitted by the moon, by means of lenses and ordinary thermometers. The author refers to his observations made some twenty years ago, when he applied thermo-electric apparatus, as well as spirit thermometers and lenses, and obtained results fully confirming those made and recorded by the Italian *savants* just alluded to.

Colouration of Glass under the Influence of Direct Sunlight.—M. Bontemps.—The author, who is the managing director of the celebrated crystal glass works at Choisy le Roi, states, after referring to the observations on this subject made by the immortal Faraday, in 1824, and MM. Gaffield and Pelouze, in 1863 and 1867, that his observations lead to the following results:—Within three months after having been exposed to sunlight, the best and whitest glass made at St. Gobain is turned very distinctly yellow; extra-white glass (of a peculiar mode of manufacture) has become even more yellow, and gradually assumes a colour known as *pelure d'oignon*; glass containing 5 per cent of litharge was also affected, but far less perceptibly; crystal glass, made with carbonate of potassa (the other varieties referred to contain carbonate of soda), litharge, and silica, was not at all affected; English plate-glass, made by the British Plate-Glass Company, and exhibiting a distinctly azure-blue tinge, remained, also, unaffected. The author attributes this colouration, which begins with yellow and gradually turns to violet, passing through red *pelure d'oignon*, to the oxidising effects of the sun's rays upon the protoxides of iron and manganese contained in glass.

Physical Properties of Arable Soil.—M. Hervé-Mangon.—This paper is divided into the following sections:—Microscopical examination of arable soil; determination of the calorific properties of arable soil; condensation of gas in soils; diffusion of gas through soils; tension of aqueous vapour in soils.

Copper Mines of Lake Superior, and Discovery of Tin in the State of Maine, U.S.—M. Jackson.—In the shape of a letter, written by the author to M. Elie de Beaumont, the author states that, in June last, there was found in the Phœnix copper mine, near Lake Superior, a mass of native copper measuring 63 × 32 × 4 feet, weighing 2000 tons, and valued at 400,000 dollars. In some parts, this mass has, instead of its average 4 ft., 7 ft. thickness. As to the site where the tin ore has been discovered, the author states that he received a sample, sent to him from Winslow by a Mr. Moore, and that, on analysis, he (M. Jackson) found the ore to yield, in its crude state, 46 per cent of pure tin, and after washing, about 75·5 per cent. There exist some forty mineral veins containing the ore, and these veins are workable.

New and Important Works.—M. E. de Beaumont.—In his capacity as one of the perpetual secretaries, the author calls particular attention to two works—viz., that of the illustrious geologist and vice-president of the Belgian Senate, M. Omalius d'Halloy, "On the Human Races, or Elements of Ethnography," which is highly eulogised for its clear and distinct language and simplicity of reasoning; and the work of M. Burmeister, "The History of Creation," which has now reached its seventh edition, and is translated into no less than seven different languages, the original being written in German. The eminent perpetual secretary above named speaks of this work as a most masterly exposition of scientific truths placed before the public in a very attractive and pleasant shape.

Revue Hebdomadaire de Chimie, November 11, 1869.

The number contains the following original matter:—

Powders to which Aniline Colours are Added.—M. Mène.—It appears that there are met with in the trade, a series of powders, of comparatively inert nature, with which aniline colours are incorporated. The author says—These substances are chiefly starch, which has been made to absorb alcoholic solutions of the different aniline dyes, and the coloured powders so obtained are employed in the manufacture of coloured printing-inks. As an improved method of the manufacture of such powders (the author says), I employ the following process:—Dissolve, in ¼ a kilo. of 95 per cent alcohol, 10 grms. of copal resin and 1 grm. of magenta red; filter the solution, and incorporate therewith, afterwards, so much dry starch as will form a friable uniformly-coloured mass. The mixture is dried in a properly-constructed drying apparatus, and next ground to powder. When a violet tinge is desired, only half the quantity of magenta-red is applied, and the other half replaced by ultramarine. The addition of copal has the effect of fixing the colouring matter to the starch.

A New Kind of Burette.—M. Gondolo.—This piece of apparatus consists essentially of the graduated tube generally applied; but it is improved upon in the following manner:—The internal conical opening at the bottom is shut by a very carefully-ground-in glass plug of conical shape. To this plug is soldered a glass rod, running through the length of the graduated tube, and passing through a cork at the top; in the cork, a spring has been ingeniously placed, in such a manner as to force the glass rod down, and keeping the plug tightly fitting the opening at the bottom. When it is desired to use the burette, which is, of course, firmly fixed in a proper stand, the hand of the operator lifts the end of the glass rod, which projects outside the cork, for a moment, and, on releasing the action of the hand, the plug is shut again by the action of the spring. Provision is made for the admittance of air, of course; and, according to the author's statement, this kind of burette is now very generally in use in France and Germany, and giving great satisfaction to all who use it.

Detection of Adulterations of Soft Soap.—M. Arbeller.—Soft soap is frequently adulterated by the addition of from 20 to 25 per cent of raw starch, with the view of giving to the soap an appearance which, if genuine, is due to solid stearates formed therein. The microscopic investigation will, of course, readily detect this fraud; but if it is required to apply a chemical test, the author states that 10 grms. of the sample of soap should be taken and dissolved, without the application of heat, in alcohol of 85 per cent; the soap, if unadulterated, will be readily dissolved, leaving no residue. If any residue is left, it can be tested by the well-known methods for starch, as well as for other impurities. Lime is sometimes present.

Trade in Flowers Used for Perfumery.—M. Contet.—From this paper we abstract the following:—In order to obtain, by distillation, 1 kilogramme of the undermentioned essential oils, the annexed quantities of parts of plants are required:—Neroli, 100 kilos. of orange blossom; roses, from 10 to 30,000 kilos. of petals of roses; petitgrain, about 500 kilos. of the leaves of the orange-tree; mint, about 500 kilos. of leaves; lavender, about 250 kilos. of flowers; geranium, about 2000 kilos. of the leaves. The extent of the trade of some of these articles may be inferred from the fact that the neighbourhood of Nice alone produces annually a value of £8000 of one single kind of flower, the well-known sweet-smelling Nizza violet. The leaves of the orange-tree are valued at about 20 francs per 100 kilos. Among the perfumes more generally known in Southern than in Northern Europe belongs the *cassies* (*Acacia farnesiana*), frequently used by both French and Spanish ladies to impart a pleasant perfume to their linen.

November 18, 1869.

Preparation of Gilders' Glue.—M. Totin.—Rabbit skins are cut up to shreds as small as vermicelli, and boiled for some time on a water-bath after previous addition of a sufficient quantity of water. The fluid is separated from the portion of the skin insoluble in water by passing through a sieve; and to the fluid, while yet hot, is next added a solution of 100 grms. of sulphate of zinc and 25 grms. of alum, previously dissolved in pure and boiling water. The mixture is thoroughly stirred up and again filtered through a fine sieve; after this, the clear fluid is poured into a suitable vessel, and left to solidify, which takes place after twenty-four hours in winter and forty-eight in summer. When the solidification is complete, the gelatinous mass is cut up into oblong squares and dried, as is usual with glue. When required for use, the dry glue should be soaked first, for about ten hours, in cold water, and next melted by the aid of a water-bath. 1 kilo. of this dried glue yields a thick solution with from 8 to 10 litres of water.

Preparation of Albumen from Blood.—M. Dolfus-Galline.—The increasing demand for albumen, especially for the use of calico-printing (fixing of pigment and other colours), has at various times led to attempts to obtain a supply of this article from the blood of slaughtered oxen and sheep. The author of this paper describes at great length a process invented by him, and actually in operation on the large scale at the *abattoirs* of Dornach, France. The process is based upon the fact of the coagulation of the so-called cruor of the blood, and its separation from the serum thereof, the latter yielding, by cautious management, a dried albumen which can be applied instead of egg albumen for clear and bright colours, while the former may be manufactured into an albumen suitable for dark pigments. 10 litres of serum yield 1 kilo. of dry colourless albumen, and the blood of two-and-a-half oxen yields just sufficient serum to obtain this quantity of albumen; the blood of ten sheep and seventeen calves also produces the same quantity of dry albumen—viz., 1 kilo.

Gas Aérifuge.—M. Rouillé.—The author describes and elucidates, by a woodcut, an apparatus suitable to manufacture gas from the essence of petroleum. In reality, the gas is simply atmospheric air saturated with the vapour of that essence and conducted through pipes. From experiments which are described in this paper, and which appear to have been fairly and scientifically conducted with impartiality, this mode of gas-lighting is fully 21 per cent cheaper than the use of coal-gas, in Paris, for equal illuminating power. The vapour-gas, however, yields a better light; its illuminating power is far greater, for equal consumption, than that of coal-gas, and the products of its combustion are completely free from sulphur and ammonia. The apparatus are simple and efficient, and may be inspected in operation at No. 211, Rue Lafayette, Paris, where, on every Tuesday and Friday evening, the public are admitted to a room purposely fitted up for photometrical and other experiments.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 201, September, 1869.

This periodical contains the following papers and communications bearing upon chemical subjects:—

Researches on the Bleaching of Woven Tissues.—M. Kolb.—There exist in the linen fibre, along with cellulose, two distinct substances—one of these is pectic acid, which is readily and very completely eliminated by alkalies; the other is a colouring substance, which is generated during the roating of the flax, giving thereto a greyish hue, and resisting the solvent action of all known solvents, and only separable from the cellulose by dissolving the latter in the ammonio-copper solution. While the quantity of pectinic products amounts in flax to from 15 to 36 per cent, this greyish matter is present therein in infinitesimal small quantity. Chlorine and hypochlorites discolour this substance, but do not dissolve it; perfect bleaching consists, therefore, in two operations—(1) elimination of all yellow colouring matter by means of alkali; (2) oxidation, and hence decolouration, of the greyish matter, which does not, however, as is generally assumed, thereby become soluble in alkalies. The author proposes the use of dilute liquid ammonia as the best so-called antichlorine, and also because it is simultaneously antacid.

Preservation of Butchers' Meat.—M. Gorges.—The process in use on the large scale by the author at Monte-Video is, briefly, as follows:—The meat, in pieces weighing from 2 to 50 kilos., is placed in a mixture of water (85 per cent) the rest being hydrochloric acid, glycerine, and bisulphite of soda. After having been steeped for some time, the pieces are taken out and dusted over with finely-powdered dry bisulphite of soda, and then packed in air-tight boxes filled as full as possible. In this state, the meat keeps fresh any length of time, and becomes perfectly fit for use—equal to fresh butchers' meat—by steeping for a short time in water to which vinegar has been added, and afterwards exposure to air. The author manufactures, at the place above named, an excellent extract of meat, which can be sold in Europe at 6 francs per kilo.; the price of the preserved meat, of which it would be easy to supply to London and Paris daily over 10 tons, is from 50 to 60 centimes per kilo.

Purification of Sewage Water.—M. Durand-Claye.—From this lengthy paper we quote the fact that the mother liquor of the manufacture of sulphate of alumina clarifies and purifies the liquid in question better than any other substance tried by the authors on the large scale. The expense only amounts to 0·0125 franc per cubic metre of fluid (rather more than 35 English cubic feet).

Cosmos, November 20, 1869.

This number contains the following original matter relating to chemistry and allied sciences:—

Analysis of the Meteorite of Deesa.—M. Domeyko.—This meteorite was observed in Chili, near Santiago, and the author, Inspector-General of Mines to the Republic alluded to, gives, in a lengthy paper, the following chemically-interesting particulars:—The metallic portion of the stone has, at 12°, a specific gravity of 7·751, and consists, in 100 parts, of—Iron, 87·17; nickel, 8·75; insoluble silicate, 2·40; phosphuret of iron and nickel, 1·42. The stony part of this meteorite is exceedingly hard, scratches glass readily, and is not scratched by hardened steel, and assumes a brilliant polish. The sp. gr. of this substance is, at 12°, = 3·589; it contains 12·62 per cent of nickeliferous iron. 58·45 per cent is soluble, and 41·55 per cent not soluble in HCl. The insoluble portion consists of—Silica, 18·64; magnesia, 17·89; protoxide of iron, 3·71; traces of soda and alumina; nickeliferous iron, 12·62; troilite, sulphide of iron of meteorites, a peculiar protosulphide of iron, 5·01 (we quote the original exactly, but the total adds up to 59·87, as it is given there). The portion soluble in acid consists of—Silica, 20·79; magnesia, 9·70; protoxide of iron, 6·99; lime, 1·45; trace of soda; alumina, 2·27; peroxide of iron, 0·41; with traces of sesquioxide of chromium, phosphorus, and carbon. The insoluble portion approaches the composition of the peridote, and the soluble portion that of pyroxenic minerals.

Lectures at the Conservatoire des Arts et Métiers, Paris.—While the requirements of technical education are often discussed, many of our readers will, perhaps, be interested with the following list:—Geometry applied to arts; descriptive geometry; mechanics applied to arts; civil architecture; applied natural philosophy; applied chemistry; industrial chemistry; the chemistry of dyeing, glass making, and ceramic art; agricultural chemistry; lectures on the theory of agriculture; agricultural engineering; spinning and weaving; political economy and industrial legislation; industrial economy and statistics. Among the lecturers are MM. Becquerel, Peligot, Tresca, Payen, de Luynes, Boussingault, &c.

Mineral Substances applied for Staining Glass and Porcelain.—M. Meunier.—The colours applied to porcelain and glass are in reality coloured glasses, which are burnt into the mass of the white glass or china. As regards the latter, in most cases, after it has been glazed, since most of the substances used as colouring matter do not stand a very strong heat (technically, in French, *grand feu*)—that is to say, the heat at which the porcelain is fired—the burning-in of the colours is effected in muffles. As colouring matters for porcelain are used:—Peroxide of iron for red (brick), brown, violet, yellow, and sepia; oxide of chromium for green; oxide of cobalt and nitrate of protoxide of cobalt and potassa for blue and black; oxide of uranium for orange and black; oxide of manganese for violet, brown, and black; oxide of iridium for deep-toned black; oxide of titanium for yellow; oxide of antimony for yellow; black oxide of copper for green, and red oxide (suboxide) of copper for red; chromate of lead for yellow; chromate of baryta for yellow; chloride of silver for red; chloride of platinum, and chloride of platinum and ammonium, for steel-colour (in fact, metallic platinum); purple of cassius for purple and rose-red colour. Only the following substances stand, without deterioration or volatilisation, the highest heat of the porcelain furnace (they are *couleurs grand feu*):—The oxides of uranium, cobalt, chromium, manganese, iron (peroxide), and titanium. Most of the substances mentioned are not used as such in pure state, but require either to be mixed very intimately, often by a previous ignition with various fluxes, or, also, with other substances, to produce the required hue and shade of colour. The chemistry of the colouring matters required by the artists who paint on porcelain is one of the most difficult and intricate portions of the application of that science to art.

Bayerisches Industrie und Gewerbeblatt, September, 1869.

Among the official announcements in this number, we notice the *stries lectionum*, or programme of the winter session of the Royal Polytechnic School at Munich, containing the following sections:—

Mathematical sciences; natural sciences; engineering and architectural science; mechanico-technical science; chemico-technical sciences; general class, including modern foreign languages; drawing class.

Police des Mines et Carrières.—An excellent model of the rules and regulations to be observed for the safety of the working of mines and quarries.

Central Air-Heating Stove.—M. Broc.—There is added to this excellent paper a series of drawings. The stove is designed for heating large buildings, as well as private dwellings, keeping up throughout every part thereof a uniform heat at very little expense.

Precautions Required to be taken by those who Work with Mercury.—Dr. Pappenheim.—This paper is the first instalment of a lengthy memoir on the subject of the volatility of mercury, and on tests for its presence in the atmosphere, especially of workshops. It appears that living plants are so highly sensitive to vapours of mercury that they are the best tests for the purpose of detecting even very minute quantities of the vapours of that metal, especially when the plants are young. The effect of mercury upon plants is the decolouration of all the green parts, especially the leaves.

Utilisation of Scraps of Tinned Iron.—M. Bock.—The scraps are placed in a tank made of stout sheet iron. To 1 cwt. of scraps, 6 lbs. of flowers of sulphur, 10 lbs. of caustic soda, and a quantity of water are added, and the mixture brought to ebullition by means of steam, introduced into the tank by means of a suitable pipe. The boiling is continued for about half an hour; the liquor is filtered, evaporated to dryness, and ignited with access of air. The ignited mass is lixiviated with water, yielding stannate of soda and sulphate of soda, which are separated from each other by their different degree of solubility; both salts crystallise.

Neues Jahrbuch für Pharmacie, von Dr. F. Vorwerk, September, 1869.

This number contains the following original papers and communications:—

Some Little-Known Poisonous Mexican Plants belonging to the Order of Compositæ.—Dr. Huseman.—It appears that the plant known as *Its cuimpatli, Yerba de Puebla, Senecio canicida*, has been submitted to a chemical investigation by the Mexican chemist, De la Loza; he detected a peculiar organic acid, which he called senecic acid. This acid should, according to this chemist, possess poisonous properties; it forms, with potassa and ammonia, deliquescent salts; neither the acid itself, nor its alkaline salts, are precipitated by the soluble salts of lime, magnesia, mercury, silver, copper, and platinum. The acid is soluble in alcohol, and is obtained by treating a decoction of the plant with acetate of lead and removal of the excess of lead by means of dilute sulphuric acid; the fluid so obtained, after filtration, is evaporated to the consistency of a syrup, and left standing for a few days. The acid separates in small, but deliquescent crystals; these are collected and purified by treatment with strong alcohol. The acid and its salts are very poisonous; but the plant and its alcoholic extract are used in Mexico as a powerful febrifuge and anthelmintic.

Contributions to the Search for, and Detection of Blood-Stains.—M. Hirsch.—There is nothing in this paper which is not well-known to all who, in their capacity as forensic chemists, may have to deal with this subject.

Testing Antimony for Arsenic by the Moist Way.—M. Ramp.—The author states—During the latter end of last year, on the occasion of the inspection of apothecaries' shops in Prussia, a quantity of tartar emetic was found to contain arsenic; as a consequence thereof, a report was made to head-quarters, at Berlin, and a rigorous inquiry and investigation set on foot by order of Dr. de Mühler, as minister for medical affairs and police (*medisinal polizei*). The methods of testing for arsenic, when mixed up with antimonial preparations, were carefully considered, and the following method of testing, due to the researches of Mine Inspector Strohmeyer, adopted:—2 grms. of the suspected tartar emetic are reduced to a fine powder and dissolved in 4 grms. of pure hydrochloric acid (sp. gr., 1·124). The glass vessel wherein this solution is made ought to be narrow, and capable of being well closed, and of sufficient size to contain an additional quantity of at least 30 grms. more of hydrochloric acid. A quantity of pure hydrochloric acid should be thoroughly saturated with sulphuretted hydrogen gas, and of this acid a quantity of at least 30 grms. is added to the solution of the tartar emetic. The glass vessel containing the solution is well corked, and, after having been shaken up, set aside; the turbidity which at first appears soon subsides (if it does not do so, it is due to the too great saturation of the HCl with HS, and should be remedied by the addition of some pure HCl). If no arsenic is present at all, the liquid remains perfectly colourless; but the slightest trace of arsenic gives rise to a yellow colouration, and very soon after to a perfectly perceptible pure yellow precipitate of sulphuret of arsenic.

Zeitschrift für Chemie von Beilstein, No. 20, 1869.

On Phosphamides.—M. Schiff.—After briefly referring to his former experiments on this subject, and commenting, in a few words, on Dr. Gladstone's treatise on the action of ammonia upon oxychloride of phosphorus, the author says—When perfectly dry ammonia gas is brought into contact with oxychloride of phosphorus, so much heat is at first set free that it is necessary to moderate the action considerably; but it is not possible to eliminate the whole of the chlorine, unless the product first obtained be repeatedly treated with ammonia. The chloride of ammonium can be removed by hot water, since neither that fluid, nor, also, dilute acids, have any decomposing effect upon the triamide thus formed. When phosphotriamide is heated without access of air, it is converted into monophosphamide, NPO, the loss of weight amounting to about 36 per cent. It is clear that only ammonia is disengaged, and no vapours of chloride of ammonium are detected at all, which would certainly make their appearance if a chlorinated amide were dealt with. When phosphoric acid is considered as—

$$P\begin{Bmatrix} O.OH \\ OH \\ OH \end{Bmatrix}$$

and the oxychloride of phosphorus as—

$$P\begin{Bmatrix} O.Cl \\ Cl \\ Cl \end{Bmatrix}$$

the meaning is that one of the atoms of chlorine has a different chemical function than the two other atoms; and it is just possible that that very one atom is less readily acted upon than the rest. When pentachloride of phosphorus is suffered to act upon aniline, a rather violent reaction takes place; but, with careful management, a whitish-coloured substance, insoluble, and thereby undecomposable in cold water and dilute acids, is obtained; when, however, this substance is boiled with water, it is split up, and phosphate of aniline is among the products of decomposition. The original product is phosphodianilide—

$$N_3\begin{Bmatrix} PO \\ 3C_6H_5 \end{Bmatrix}$$

and its formation is represented as follows:—1. First action of aniline and pentachloride of phosphorus—

$$PCl_5 + 3C_6H_7N = N_3\left\{\begin{matrix} PCl_2 \\ 3C_6H_5 \end{matrix}\right\} + NH_4Cl + 2HCl.$$

2. On being next treated with water—

$$N_3\left\{\begin{matrix} PCl_2 \\ 3C_6H_5 \end{matrix}\right\} + H_2O = N_3\left\{\begin{matrix} PO \\ 3C_6H_5 \end{matrix}\right\} + 2HCl.$$

Cyantoluylen.—M. Irelan.—The author has investigated the behaviour of chlorotoluol-sulphate of potassa towards cyanide of potassium. When an intimate mixture of these salts is heated, a sublimate is obtained, exhibiting, after re-crystallisation from alcohol, a solid substance forming needle-shaped crystals composed according to the formula—

$$C_9H_6N_2 = C_7H_5\begin{Bmatrix} CN \\ CN \end{Bmatrix}$$

On being boiled with a solution of caustic potassa, ammonia is given off, and if, afterwards, sulphuric acid is added, a dicarbon acid (*dicarbonsäure*) is precipitated, which acid is, in all probability, uvitinic acid. Dichlorotoluolsulpho acid yields, when submitted to the same treatment, a cyanised compound.

Behaviour of Epichlorhydrine towards Neutral Sulphate of Potassa and Cyanide of Potassium.—M. Paszchke.—On mixing 1 molecule of epichlorhydrine and 1 molecule of K_2SO_3 in concentrated aqueous solution, and boiling the mixture, a deep yellow-coloured, acrid-smelling fluid was obtained, which solidified on cooling, yielding a crystalline compound, which, after having been repeatedly re-crystallised, yielded a salt, $C_3H_6S_2O_7K_2 + 2H_2O$; that is to say, disulphoglycerinate of potassa. The reaction of neutral sulphate of potassa upon epichlorhydrin is rather complex, and exhibits two different stages;—

$$1.\ \left.\begin{matrix} CH_2 \\ CH_2O \\ Cl \end{matrix}\right\} C + 2\left(\begin{matrix} KO \\ KO(SO) \end{matrix}\right) = \left\{\begin{matrix} CH_2K \\ CH_2O \end{matrix}\right\} C\left(\begin{matrix} (SO_2)OK \\ SO_2OK \end{matrix}\right) + KCl.$$

$$2.\ \left.\begin{matrix} CH_2K \\ CH_2O \end{matrix}\right\} C\left(\begin{matrix} (SO_2)OK \\ SO_2OK \end{matrix}\right) + H_2O = \left\{\begin{matrix} CH_2 \\ CH_2O \end{matrix}\right\} C\left(\begin{matrix} (SO_2)OK \\ SO_2OK \end{matrix}\right) + KOH.$$

When 20 grms. of epichlorhydrine were gently heated along with an aqueous solution of cyanide of potassium (15 grms. KCy, and 60 grms. H_2O), a rather violent reaction sets in; but, with proper management, a crystalline compound is obtained, which is readily dissolved by water and alcohol, but sparingly by ether; this substance is composed according to the formula C_4H_5NO.

Identity of Dichlorhydrine obtained from Glycerine and Epichlorhydrine.—The author has compared dichlorhydrine, prepared by passing hydrochloric acid gas into a mixture of four parts of glycerine and three parts of glacial acetic acid, with the dichlorhydrine prepared by passing hydrochloric acid gas into epichlorhydrine. The former boils at from 176° to 177°, and has a sp. gr. of 1·366 at 17·5°; the latter boils at from 175° to 176°, and has, at 17·5°, the very same density as just mentioned. They are both equally soluble in water.

Dicyannaphthaline.—MM. Baltzer and Merz.—When dipotassium-disulphonaphthalate is submitted to distillation with excess of cyanide of potassium, a fluid is obtained which solidifies in the neck of the retort. This crude substance contains two dicyannaphthalines, of different solubility in alcohol. The more readily soluble of the two exhibits, after having been purified, a silky-looking, needle-shaped, crystalline mass, devoid of taste and smell, and fusing at 181°; this substance is completely decomposed at about 200°, and the action of either aqueous solution of caustic potassa or hydrochloric acid yielding, in each instance naphthalin-dicarboxylic acid, a beautifully crystalline compound. The other dicyannaphthaline, far less soluble in alcohol (boiling only), fuses at 260°, is a crystalline compound, and undoubtedly identical with a substance obtained by MM. Darmstädter and Wichelhaus from dinaphthalin-disulpho acid.

Isomeric Cresoles and their Derivatives.—MM. Engelhardt and Latschinoff.—This lengthy memoir opens with an introduction

reviewing the labours of so large a number of scientific chemists who have experimented on this subject, that their names alone would fill a too considerable space. Of the paper itself, we can only give the titles of the headings of its different sections:—Isomeric toluolsulpho acids, $C_7H_7(HSO_3)$; α and β toluolsulpho salts; isomeric cresoles, C_7H_8O; α cresole; α benzoyl-cresole, $C_7H_7O(C_7H_6O)$; α ethyl-cresole; α cresol-sulpho acid; α cresol-sulpho-potassium, $C_7H_6(KSO_3)OH+2H_2O$, and a series of similar salts of various bases; α cresol-disulpho acid; α cresol-disulpho-potassium—

$$C_7H_5(KSO_3)_2OH+3H_2O;$$

β cresole, C_7H_8O; β benzoyl-cresole; β cresol-sulpho acid; γ cresole, C_7H_8O; γ benzoyl-cresole, $C_7H_7O(C_7H_6O)$; γ ethyl-cresole; γ cresol-sulpho acid; isomeric cresotinic acids, $C_8H_8O_3$; isomeric toluylic acids. The memoir is an abstract from a very lengthy paper published in the Russian language, and is so full of formulæ and references to different papers published on this subject that it is not possible to enter into more details here.

Some of the Products of Decomposition of Trichloromethyl-sulphurous Acid.—M. Loew.—When trichloromethylsulphonbromide is submitted, in alcoholic solution, to a temperature of about 110°, while enclosed in a sealed tube, and the contents of the tube are next diluted with water, a heavy oil is separated, while the supernatant liquid contains free sulphurous acid; this reaction takes place according to the following equation:—

$$\underbrace{(CCl_3)[SO_2]Br}_{\text{Trichloromethyl-sulphonbromide.}} = \underbrace{CCl_3Br+SO_2}_{\text{Carbontrichloro-bromide.}}.$$

Along with the sulphurous acid, a small quantity of trichloromethyl-sulphonic acid is detected. Carbontrichlorobromide boils at 98°, and is, when passed through a dull-red-hot combustion tube, decomposed into bromine and solid chloride of carbon. The author did not succeed in obtaining the analogous iodide; neither did he obtain a trichloromethyl-sulpho urea. While attempting to prepare dichloromethylen-sulphon, by submitting trichloromethylsulphinate of sodium to destructive distillation, according to the formula—

$$(CCl_3)[SO]ONa=NaCl+(CCl_2)[SO_2],$$

a very small quantity of that substance was obtained; but the reaction went further, and other substances, among which, perchloride of ethylen, were obtained, this reaction being represented by—

$$2((CCl_2)[SO_2])=2SO_2+C_2Cl_4.$$

Action of Direct Sunlight upon Iodide of Potassium.—M. Loew.—A solution of iodide of potassium is, even when kept in well-closed bottles, slowly decomposed by the action of daylight, and assumes a somewhat yellowish tinge, due to free iodine. The author filled a number of glass tubes for about from one-half to three-fourths of their capacity, with a solution of iodide of potassium, and, after having sealed these tubes, exposed them to direct sunlight. Another set of tubes were likewise filled with the same solution, but all air was expelled, and the tubes sealed during and after the solution had been boiling for a considerable time. These tubes were also exposed to the action of direct sunlight; after three and four months' exposure, the tubes and contents were examined; those wherein no air at all was left were found to be perfectly colourless, no decomposition of the contents having taken place. As regards the other tubes, the following results are noticed:—(1) Under the influence of light, the oxygen of the air decomposes iodide of potassium, iodine in small quantity is set free, while hydrate of potassa is found in the liquid. (2) This decomposition is limited, and does not, even when a large quantity of oxygen is present, increase, because a portion of the iodine set free enters again into combination with the caustic potassa set free, forming iodide of potassium and iodate of potassa. (3) The testing for ozone by means of a solution of iodide of potassium and starch (or paper prepared therewith) is of no value whatever, unless care has been taken to exclude direct sunlight.

Precipitation of Cobalt by Sulphuretted Hydrogen, and Purification of Salts of Manganese containing Cobalt.—M. Muck.—The gist of this paper is that boiling-hot solutions of cobalt are, even when free acid is present, readily precipitated by sulphuretted hydrogen. When there is added to such a solution carbonate of manganese, in sufficient quantity, the sulphide of cobalt is completely precipitated, and, after elimination of the free HS, a pure solution of manganese is obtained. The author also states that there occur many ores of manganese which contain large quantities of cobalt ore.

Phenol from Oxybenzoic Acid.—M. Rosenthal.—The author has prepared phenol by distilling oxybenzoic acid with lime; and, on investigation, found it to be in all respects identical with the phenols obtained from tar, salicylic acid, and paraoxybenzoic acid.

Ethyloxybenzoic Acid.—M. Rosenthal.—The author says—I tried to prepare, from oxybenzoic acid, an acid of the formula—

$$C_6H_3\begin{cases}OH\\COOH\\COOH\end{cases}$$

by causing carbonic acid and sodium to act upon the compound—

$$C_6H_4\begin{cases}OH\\COOC_2H_5.\end{cases}$$

Instead of obtaining the desired result, the author obtained the compound—

$$C_6H_4\begin{cases}OC_2H_5\\COOH\end{cases}$$

which is undoubtedly due to the conversion of Na and C_2H_5; this substance is ethyloxybenzoic acid, and was, on comparison, found to be in every respect identical with the compound obtained by heating oxybenzoic acid with KHO and C_2H_5I.

Les Mondes, November 18, 1869.

Refined Resin Oil.—M. Curie.—When resin is submitted to destructive distillation, it yields various oils of different specific gravity, acetic and phenic acids, water, tar, and gases; the crude oil is often applied for the making of printing-ink, as well as waggon grease. The author treats the crude oils, tar inclusive, with lime, and, by fractioned distillation between 140° and 260°, obtains what is known as essence of resin. At 370°, an oil is obtained which, for lubricating purposes, is nearly as good as best olive oil, and is an excellent substitute for turpe in oil-paints. This oil is sold at Bordeaux at 50 francs (£2) per 100 kilos.

Treatment of the Sewage of the City of Rheims.—MM. Houzeau, Devédeix, and Holden.—In a lengthy paper, the authors detail the results of a series of experiments made on a sufficiently large scale to form a proper opinion as to the value and permanent applicability. The processes which have been applied are:—(1) Treatment with sulphate of iron and lime; (2) treatment with lignite and lime; (3) treatment with small coal (dust, rather) and a small quantity of sulphate of iron and lime. The two first processes yield a manure; the last a fuel. The city of Rheims is situated on and near the banks of the Vesle, and contains, exclusive of the large garrison, a population of about 61,000 inhabitants. According to a report of M. Maridort, Professor of Chemistry at this place, the process, by means of the use of lignite, is a complete success.

NOTES AND QUERIES.

Reducing the Metal from Impure Chloride of Zinc.—Can any of your readers inform me of a practical and profitable method of reducing the metal from impure chloride of zinc?—An Old Subscriber.

Aluminium Sulphide and Phosphide.—(Reply to "D. H.")—See Berzelius's "Traite de Chimie," vol. ii., p. 157 (Paris, 1846), and "Handbook of Chemistry," by Gmelin, vol. iii., pp. 309 and 311. Both works may be inspected at the Library of the Commissioners of Patents.

Atomicity of Aluminium.—(Reply to "Dubitans.")—Aluminium is tetratomic and pseudo-triatomic, like carbon. In the simplest formulæ of aluminium compounds, the metal is represented as triatomic, as, for example, $Al'''Cl_3$ $Al'''K'_2SO_4+12H_2O$; but the specific gravity of the vapour of aluminium chloride shows that the true formula is Al_2Cl_6, and not $AlCl_3$. Hence it is probable that each aluminium atom is really tetratomic, the constitution of the chloride being—

$$\begin{array}{l}Al^{iv}=Cl_2\\|\\Al^{iv}=Cl_2\end{array}$$

—Atomicity.

Gas and Oil Furnaces.—No one seems inclined to give me the information as to getting up white heats in a small furnace with ordinary gas from the mains, from which I infer no one of the readers of the Chemical News has done it, nor sees his way how to do it. As I find, on inquiry at the gas office here (Runcorn), that they will not allow any reduction in price for use in such quantity, save some 2½ discount, I must try oil of some sort or other. Which is best for my purpose? I want to have as *clean* a heat as possible—that is, free from sulphur and deposit of any kind that would interfere with the action of the vapours I introduced on the clay goods in the kiln. At first thought, you would fancy a flame from oil should not leave any deposit; but I am not so sure, as the gas from a gas producer of Siemens's covered the goods with brown-red dust.—J. C.

MEETINGS FOR THE WEEK.

Monday, Dec. 6th.—Royal Institution, 2. General Monthly Meeting.
—— Medical, 8.
—— London Institution, 4.
Wednesday, 8th.—Society of Arts, 8.
—— Geological, 8.
—— Microscopical, 8.
Thursday, 9th.—London Institution, 7.30.
—— Royal, 8.30.
—— Zoological, 8.30.
—— Royal Society Club, 6.
Friday, 10th.—Quekett Club, 8.

TO CORRESPONDENTS.

R. K.—Picrate of potash explodes on concussion; detonation is greatly increased by the addition of chlorate of potash.

T. C. Winton, A.B., M.D.—Victoria orange may be obtained of Messrs. Roberts, Dale, and Co., Manchester.

Librum.—Fresenius's "Qualitative and Quantitative Analysis," published by Churchill.

R. H.—Any person can receive fees as an analyst without passing an examination or proving his competency.

Captain Ross, R.A.—We regret that we have no space for your articles. They will be returned to any address you may forward.

THE CHEMICAL NEWS.

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ON THE

CONSTITUTION OF SODIC SULPHATE IN SOLUTION.

By CHARLES TOMLINSON, F.R.S.

II. LÖWEL'S HYPOTHESIS—ANOTHER HYPOTHESIS.

As there is no harder or pleasanter intellectual work than original research, so there is no harder or more unpleasant moral work than having to modify or re-construct one's own theory after having spent years of toil in establishing it, and even after it has been accepted with applause by competent critics. This is what M. Löwel has done; and I cannot sufficiently honour and respect him for his candour in having been the first to awake to the sense of his own defects, and to wind up his work by saying so.

As already stated, his first five memoirs were published between 1850 and 1855. In his sixth and last memoir, published in 1857, he is led, chiefly by three considerations, to suppose that, between the boiling point of a saturated solution of sodic sulphate (103·17° C.) and the point when the 7-atom salt begins to be deposited (18°), it is not this modified salt, but the anhydrous variety, that is held in solution. His reasons are the following:—

1. That the 10-atom salt parts so readily with its water of crystallisation by mere exposure to the air at temperatures between 15° and 20° C.

2. That Faraday found, on evaporating a solution of the 10-atom salt below 100° C. (or, according to Mitscherlich, below 40°), the anhydrous salt was deposited.

3. That, in boiling for some time a saturated solution of the 10-atom salt, small, hard, granular crystals of the anhydrous salt are formed as the solution becomes concentrated.

But M. Löwel cannot get rid altogether of his molecular theory. Although he admits that, between the boiling point of a saturated solution (103·17° C.) and the point when the modified salt begins to be formed (18°), the anhydrous salt is held in solution, yet, at and below 18°, a molecular change comes over the solution, by virtue of which it holds or begins to deposit the 7-atom salt.

In weaker solutions, it is admitted that this molecular change takes place at yet lower temperatures. A boiling solution of 2 parts of the 10-atom salt to 1 part of water, for example, must be cooled to 7° or 8° C. before it deposits the modified salt; while a solution of 1 part salt to 1 part of water must be reduced to 0° before the 7-atom salt is deposited. Hence the 7-atom salt is not deposited at the same temperature, but at very different temperatures, low in proportion as there are fewer saline molecules in solution. He admits that it was an error to suppose the 7-atom salt to be already formed, since such solutions do not begin to deposit the modified salt as soon as the temperature passes below the point at which the solutions would be saturated with that salt if it were really present. Thus the boiling saturated solution would be saturated with the 7-atom salt at about 26° C., and it did not begin to deposit that salt under 17° or 18°. The weaker solution (2 salt to 1 water) would, in like manner, be saturated at 18°; but it was reduced to 8° before the 7-atom salt appeared; while the still weaker solution (1 salt to 1 water) required a reduction of temperature equal to 0°. The first solution evidently contained anhydrous salt up to the very moment when it began to deposit the 7-atom salt; and there is no reason to suppose the other two solutions, although much less rich in salt, to have been differently constituted. Moreover, when the second solution has deposited the 7-atom salt at 7° or 8°, so long as it remains in contact with these crystals, it possesses fixed points or terms of saturation, limited by the temperature—that is, it deposits the 7-atom salt when its temperature is reduced, and it re-dissolves it to saturation when the temperature rises; but, if this elevation of temperature reach to 22° or 24°, so that the 7-atom salt is totally dissolved, the solution will not deposit crystals when the temperature again falls a little below 18°, but it must be lowered to 8° or 7°, just as if it had not deposited salt at all. "Hence," he says, "I conclude that the 10-atom salt, as well as the 7-atom salt, in passing into solution, at whatever temperature, gives up the whole of its water of crystallisation. Under what conditions, then, are these salts in solution? I can only give hypotheses; and, without seeking to define this condition, it may be best to say that, in passing into solution, they assume an indeterminate molecular constitution, which may be termed the molecular constitution of sulphate of soda in solution, which differs from the molecular constitution of the crystals of the 10-atom, the 7-atom, and the anhydrous salt."

Löwel has given very full tables of the solubility of each of the three forms of sodic sulphate at various temperatures, and his determinations extend to two places of decimals. "I could not," he says, "determine the point of maximum solubility of the anhydrous salt at temperatures below which it begins to deposit the 7-atom salt. At 18°, the change of state is made suddenly; the solutions become troubled, and deposit crystals of the 7-atom salt in a pulverulent form."

Here I venture to think M. Löwel missed his opportunity. If, instead of depositing "crystals of the 7-atom salt," he could have written, "the anhydrous salt," he would have saved himself from much embarrassment, and the present discussion would have been unnecessary.

It was in repeating some of M. Löwel's experiments during the cold weather of December, 1867, that I observed the sudden troubling of the solution. A stream of nearly ice-cold water was allowed to run upon a flask containing a warm supersaturated solution of sodic sulphate, when it suddenly became opaque, from the formation of a multitude of minute crystals, which seemed to increase in number on gently shaking the flask. On repeating the experiment with more care with solutions in test-tubes placed in transparent freezing mixtures, these crystals were soon recognised as the octohedra of the anhydrous salt. I will quote from my note-book a few out of many of the experiments that were made to determine what seemed to me to be a very important point; for it was this experiment that first led me to question the integrity of the molecular theory, as well as the reality of the so-called catalytic action of the sides of the flasks and of solid nuclei.

A solution of 3 parts of the 10-atom salt to 1 part of distilled water was boiled at 218° F., when a small portion of anhydrous salt was thrown down. The solution was filtered into a flask, in which it was again boiled. The flask was then plugged, with a thermometer passing through the plug. When the solution had cooled down to the temperature of the room, the flask was put into cold water. At 54°, a few well-shaped, sharply-cut, octohedra began to fall. At 50°, the number of crystals had so greatly increased as to render the solution opaque; heat currents were liberated, and the temperature rose to 58°.

Two parts of the 10-atom salt to 1 part water: octohedral crystals began to form at 48°.

One part salt to 1 of water: at 35°, a few well-shaped octohedral crystals were thrown down.

So far, then, it seemed to me to be perfectly we
out that the 10-atom salt, in passing into solutio
up the whole of its water of crystallisa
In heating the solutions, a dendritic c
anhydrous salt creeps up the side of t
the level of the solution; and, in filter

a thin anhydrous crust forms on the surface of the liquid in the filter. The proofs are manifold that the anhydrous salt is in solution; but the most convincing proof of the fact seems to me to be the throwing down of anhydrous crystals on lowering the temperature of the solutions to a sufficient degree.

The abrupt change that takes place in the curve of solubility of the 10-atom salt at 33° or 34° C. was pointed out by Gay Lussac, and explained by him that, whereas it is the saline molecule $NaO,SO_3+10Aq.$ that enters into solution, yet, beyond this point, when the solubility diminishes up to boiling, it is the anhydrous salt that is in solution.

Löwel remarks on this:—"We can easily explain why the solubility of sulphate of soda presents this curious anomaly of increasing with the temperature up to a certain maximum, and then diminishing as the temperature rises. So long as the salt is in the form of 10-atom crystals, its solubility increases from 0° to 34° C. Above 34°, this salt no longer exists; it becomes anhydrous, with a different molecular constitution and solubility. The solubility of the anhydrous salt follows an inverse order as compared with that of the 10-atom hydrate. It diminishes in proportion as the temperature rises, or, what is the same thing, it increases as the temperature falls from 103·17° (the boiling point of a saturated solution), not only to 34°, but also to 18° and 17°, when the dissolved salt undergoes a new modification in its molecular constitution, and begins to form crystals of the 7-atom hydrate."

Now, if it be true that the 10-atom hydrate remains in solution up to 34° C. (93·2 F.), solutions made below that temperature ought to deposit the 10-atom salt on cooling in close vessels, just as they do in open vessels where they are in contact with nuclei; but the fact is, such solutions still deposit the anhydrous salt. Solutions saturated at about 85°, or from that to 88° F., and filtered into flasks warmed to that point, and then plugged, were kept until the next day, without any deposit of salt. On detaining them for some time in a freezing mixture, at from 16° to 25° F., they sometimes froze, but, on several occasions, they threw down small, well-defined crystals of the anhydrous salt. Hence, it cannot be true that, up to 34° C., it is the 10-atom salt that is held in solution.

There remains still one point to be discussed. M. Löwel supposes that the supersaturated solutions, in cooling to 18° or 17° C. (64·4 to 62·6 F.), assume the molecular constitution of the 7-atom hydrate; and, further, that, when this salt is deposited, the non-crystallised portion of the solution is the mother liquor of the 7-atom salt. He determines the solubility of this 7-atom hydrate by carefully withdrawing, by means of a warm pipette, a little of the so-called mother liquor at a known temperature, weighing it, evaporating it to dryness, and so calculating the solubility of the 7-atom salt in terms of the anhydrous salt obtained by the evaporation.

But, suppose the so-called mother liquor resting on crystals of the 7-atom salt is once more a solution of the anhydrous salt, what then becomes of the table of solubilities? and what of the theory of molecular change at 17° or 18° C.?

I made a solution of about 2½ parts of the 10-atom hydrate in one part of water; boiled it, and filtered it into three test-tubes, which were then plugged with cotton-wool, and placed upright in a rack close to the window to cool. They were then put into water at from 35° to 40° F., when octohedral crystals of the anhydrous salt were deposited in all three solutions. The tubes were now returned to the rack, when, in a few hours, the 7-atom salt was formed, a few prisms with oblique summits being well marked. The tubes were now put into a freezing mixture, at 20° F., when another shower of beautiful octohedra took place. I need hardly say that, if the molecular change insisted on by M. Löwel had taken place, and if the solution resting on the 7-atom hydrate had been its mother liquor, crystals of the 7-atom hydrate must have been thrown down, and not those of the anhydrous salt.

The tubes were again returned to the rack; when, after some time, another formation of the 7-atom hydrate took place. Next day, in order to be quite sure that it was the 7-atom salt at the bottom of the tubes, the cotton-wool plug was removed from one of them, when crystallisation of the 10-atom salt at once set in from the surface, and, proceeding downwards, converted the deposit into an opaque, chalky mass, or, as Ziz says, "like boiled white of egg," the crystallisation above it being translucent, like ground glass. The two remaining tubes were put into a freezing mixture at about 10° F. The crystals were long in coming, but at length a few well-defined octohedra fell down from the solution in each tube.

I remember that Professor Daniell, of King's College, was in the habit of introducing the same experiment, under different forms, even to variations in the shape of a bottle or flask, in order that his pupils might be allured by the principle involved, rather than by the form of the apparatus. Profiting by this useful example, I prepared a solution of about 4 salt to 1 water, in flasks, where, with much less depth, there was a greater body of solution than in the tubes. The flasks were exposed to the cold of the window-ledge, where they remained all night. Next morning, there was a copious deposit of the 7-atom salt. On putting one of the flasks into a freezing mixture, at 25° F., there was an abundant liberation of anhydrous crystals from the so-called mother liquor of the 7-atom salt, but which is really a solution of the anhydrous salt.

I ought, perhaps, to apologise for drawing thus freely on my note-books for these experiments. My best excuse is that they have not been previously published. In my memoir on "Supersaturated Saline Solutions," I was satisfied with the statement, accompanied by one experiment only, that solutions of Glauber's salt, when removed from the influence of nuclei, hold anhydrous salt in solution, and deposit it on a proper reduction of temperature. Such was my conclusion two years ago; and I see no reason to alter my opinion now. On the contrary, that opinion is strengthened by experience, and by recurring to Professor Daniell's favourite process of varying and multiplying the means, so as to become more secure of the end. One such variation I cannot help giving, since it leads to the same conclusion, by means of a physical test of great practical value.

In the experiments for determining the elasticity of steam from pure water, the elasticity is diminished for any given temperature, if a small portion of a salt, soluble in water and not capable of rising in vapour with it, be allowed to ascend to the top of the mercurial column, the column rises, thereby indicating a diminished elasticity of the steam. The adhesion of the soda to the water tends to restrain the water from evaporating, and this tendency is a measurable force, and here measured; for it partly balances the tension of the water, or its tendency to emit steam, and thus makes the steam-emitting tension of a solution of soda measurably less than that of pure water at the same temperature.

Now, it is clear that, if, instead of soda, Glauber's salt be used in experiments of this kind, there would be a smaller amount of diminution in the elasticity of the steam if the salt in solution retained its water of crystallisation than if it entered into solution in the anhydrous form. In a valuable series of experiments by Wüllner,* it appears to have been established that, for solutions of various strengths (such as 10, 20, 30, &c., per cent of Glauber's salt in pure water), and at various temperatures, from 10° to 100° C., the diminution in the elasticity of the steam is proportional to the quantity of *dry* salt in solution; and, further, that, at the point of maximum solubility of this salt, no molecular change takes place, or it would have impressed itself on the curve which represents the elasticity of the steam. The general conclusion for the salts tried is that the action of efflorescent salts is

* *Pogg. Ann.*, ciii., 529, and cx., 564.

expressed in terms of the dry salt, while, for deliquescent salts, it is in terms of the hydrated salt.

I cannot wind up without entering a protest against the doctrine involved in the foot-note to M. Dubrunfaut's paper (CHEMICAL NEWS, vol. xx., p. 241), which amounts to this—that, if a man repeat the published experiments of others without knowing it, he is entitled to claim the results as original discoveries of his own. I am quite aware that credit is given to M. Löwel in our text-books for discoveries that belong to previous inquirers; and, with all due respect for him, I cannot help thinking that he would have improved his work by quoting his authorities more freely. Now, at the time when Löwel commenced his labours, a large number of well-attested facts had been established by such men as Ziz, Ogden, Faraday, Turner, Graham, and others. Löwel does refer incidentally to Ziz and Faraday, proving that he knew something of their results; and yet we are now coolly told that all those honoured names are to be swept away, and Löwel only referred to as the discoverer of the leading phenomena of supersaturation. If such reasoning and practice were applied in literature as they are on some occasions in science and the useful arts, we should realise the condition of the modern epic poet, who declared that he had splendid thoughts, only those scoundrels, the Ancients, had already appropriated them.

Highgate, N., November 24th, 1869.

ON SOME

TECHNICAL APPLICATIONS OF THE SPECTRUM MICROSCOPE.*

By H. C. SORBY, F.R.S., &c.

MY object in publishing the following paper is to show that the spectrum microscope may be applied with advantage in several departments of technical inquiry, and more especially to describe the methods useful in such investigations. Since these will be much more readily understood by means of practical illustrations, I shall not make many general introductory remarks, but reserve an account of each particular process until I come to those practical questions which require its adoption.

In the first place, I beg to refer to my papers "On a Definite Method of Qualitative Analysis of Animal and Vegetable Colouring Matters,"† and "On the Colouring Matters of Blue Decayed Wood,"‡ since much that I shall describe will be a continuation and application of what they contain. I shall make use of the same scale for measuring the position of the absorption bands, and the same notation and symbols to express the varying power of absorption in different parts. This scale is an interference spectrum with dark bands, which divide the whole visible spectrum into twelve portions of equal optical value; and it is so adjusted that the sodium line, D, is situated exactly at 3½. On this scale the principal Fraunhofer lines occur as follows:—

A .. ⅛	B .. 1½	C .. 2⅝	D .. 3½
E .. 5$\frac{11}{16}$	*b* .. 6$\frac{3}{16}$	F .. 7½	G .. 10⅛

The only objection to this scale is that its accuracy is dependent on the careful preparation of the plate of quartz. I have myself made several perfectly alike and accurate, and nothing but proper care is required. When once accurately made, no scale could be more convenient, since the bands occur at equal optical intervals over the whole spectrum, and are quite distinct when the slit is opened rather wide, which is sometimes a great advantage. In these two respects it is far superior to any other scale hitherto proposed.

The intensity of absorption will be expressed by means of dots, hyphens, and dashes; thus:—

Not at all shaded		Blank space.
Very slightly shaded	.	Single dot.
Slightly shaded	..	Double dots.
Moderately dark	– –	Double hyphens.
Very dark	—	Single dash.

When these symbols are printed *between* numbers they signify that there is a more or less strong absorption between those points of the spectrum as measured by the above-named scale; whereas when they are printed *under* numbers they signify that there is a distinct absorption band, of the intensity expressed by the different symbols, the *centre* of which is situated at that point of the scale indicated by the figures. This latter method is extremely simple and convenient, and often serves to express all that is requisite. It may, perhaps, appear imperfect to those accustomed to the study of the spectra of substances in the state of incandescence, but it is in all respects well adapted for the study of the spectra of solutions, in which a slight difference in the character of the solvent often makes far more difference in the position of the bands than any that could result from errors due to the employment of such a scale and notation. To hold the liquids under examination, I in most cases employ narrow, deep cells, usually one-eighth of an inch diameter, and half an inch deep, so mounted that they can be examined either in the line of the length or at the side; but occasionally I use rather wider, as much as two and a half inches long.

By using these narrow cells very much less material is required for successful examination, which is not only most important when very little is at command, but even in other cases often effects a considerable saving of time in filtration and evaporation.

I shall divide my subject into three principal heads, viz., 1. Various facts connected with wine; 2. Those relating to malt liquors; and—3. Such as illustrate the methods that may be employed to detect adulteration in various substances used as food or medicine.

1. *On the Colouring Matters of Wines.*

The pure colour of fresh dark grapes is best prepared by removing the skins, heating them in alcohol, evaporating the solution to dryness, re-dissolving it in a little water, filtering, and again evaporating to dryness in a small saucer, in which the colour may be kept as a stiff syrup for many months without material change. It belongs to the group of colours which I called group B in my paper in the *Proceedings of the Royal Society*—that is to say, sulphite of soda produces no immediate effect when added to a solution rendered alkaline by ammonia; but when added to one made acid with citric acid, it almost immediately removes the detached absorption in the green, so that the solution becomes very pale.

Since this colour of dark grapes is purple when dry and quite neutral, it may be called *Vitis purple*. I have not yet met with it in any other fruit, unless it be in that of the common crowberry (*Empetrum nigrum*). One of its peculiarities is that it easily passes into insoluble modifications. It belongs to my sub-group B al_o am_o, since it does not give any decided narrow absorption band in an alcoholic solution, when either neutral or with excess of ammonia. Such colours are amongst the most difficult to distinguish from one another, and I have not yet been able to discover any more satisfactory method than the following:—A slight excess of ammonia should be added to the alcoholic solution; made so dilute that the absorption in the orange part of the spectrum is distinct, but yet very far from black, and the position of the limit of the absorption towards the red end carefully measured and recorded, thus—1½ . . . .

The same limit should also be ascertained after con-

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* Communicated by the author, having been published in the *Quarterly Journal of Microscopical Science*, vol. ix., new series, p. 358.

† *Proceedings of the Royal Society*, 1867, vol. xv., p. 432.

‡ *Quarterly Journal of Microscopical Science*, January, 1869.

siderable excess of hydrochloric acid has been added to the solution, both in water and in alcohol; which solutions sometimes give the same, but sometimes materially different, spectra. These various limits of absorption vary with the depth of colour, but by taking care to have solutions which give equally strong absorptions, and comparing them side by side, it is often very easy to distinguish from one another very closely allied colours—for example, that of dark gooseberries from that of grapes, or that of fresh grapes from that of new dark wines. The difference between these latter is proved, not only by the spectra, but also by other facts.

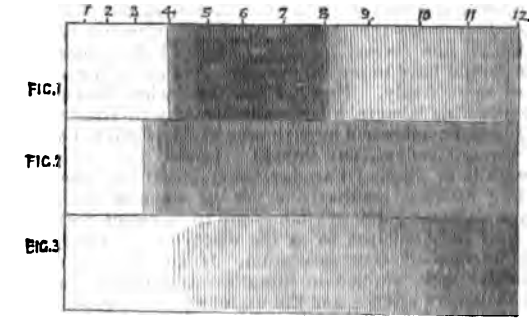
In my paper in the *Proceedings of the Royal Society* already cited (p. 443), I showed that when certain colouring matters are dissolved in water or alcohol, they give deep-coloured solutions, which rapidly fade to nearly colourless; but when these faded solutions are evaporated to dryness, the colour is completely restored to its original state, and is also made quite as dark as if it had never faded, by adding some strong acid; so that the fading is not due to decomposition, but to a molecular change rapidly taking place in dilute solutions. The colour of fresh grapes is an example of this; and by comparing with a standard which did not fade, the solution immediately after the colour was dissolved, and the same after less than an hour, when no further change occurred by keeping it longer, I found that the faded required fully five times the thickness to give the same intensity of absorption at the yellow end of the green. On the contrary, new dark wines evaporated to dryness do not fade at all in such a manner when re-dissolved in water.

This colour of new wines appears to be produced at a very early part of their formation. By dissolving the colour of the fresh grapes in the juice, adding a little yeast, and keeping the solution warm for a few days, the colour appeared to be changed into that found in new wines, and did not fade at all when re-dissolved in water. The colour kept as dry syrup for three years showed a similar change. I think it must be, therefore, due either to fermentation or to a slight oxidisation. I am much inclined to adopt the latter explanation, for if citric acid be added to an aqueous solution of the fresh colour, and then a small quantity of hypochlorite of soda, the colour is changed from pink to pink-red, the absorption is found to extend more towards the red end, and to be more uniform over the green and blue; in all which particulars it corresponds with the spectrum of new wine. No such change occurs when the wine is treated in the same manner, as though this alteration had already taken place. Both these colours belong to my group B; but when either is still further oxidised by means of rather more hypochlorite of soda, a sort of orange colour is produced, which seems to correspond with that of port wine kept for twenty years or more in the cask; and when still further changed, it becomes quite pale, like very old wines. The following table will show these facts more clearly:

Colour of dark grapes in citric acid and water	4	4½	18½ .. 11
Ditto, after adding a little hypochlorite of soda	3½	3¾	
New natural port wine	3¾	3¾	
Ditto, after adding a little hypochlorate of soda	3½	3¾	
Colour of dark grapes with more hypochlorite of soda	5	6	10
New natural port wine with ditto	5	6	10
1834 port from the cask	5	6	10

Since this change in the spectrum depending on the state of oxidisation is of considerable interest as illustrating a general law, I here subjoin a woodcut,* in order to render more intelligible to those not accustomed to the use of the symbols employed in the above table. Fig. 1 shows the spectrum of the colour of dark grapes in its natural state, in citric acid and water. Fig. 2 is the spectrum of the oxidised modifications met with in new wines; and Fig. 3 that of the per-oxidised colour found in very old wines, or formed by the more complete artificial oxidisation of the other two.

This colour of very old wine belongs to my group C, and is not changed by adding sulphite of soda to an acid solution; whereas, as already mentioned, the characteristic colour of very new wine belongs to my group B, and if it could be obtained in a pure state, would probably become nearly colourless on the addition of the sulphite. This



difference between the colour of new and old wine has enabled me to contrive a method by means of which I can ascertain the approximate age of port wine kept in the cask. In these experiments I have been very much assisted by my friends, Mr. Joseph Prestwich, F.R.S., and Mr. Alexander Hay, of Sheffield, who have most kindly supplied me with the requisite samples.

(To be continued.)

* We are indebted to Messrs. Churchill and Sons for the use of this woodcut.

NOTE ON THE AMERICAN ECLIPSE.

Dr. Morton, Professor of Chemistry in the University of Pennsylvania, has kindly forwarded me photographs of the phenomena of totality. By combining in the stereoscope pairs of these, separated by intervals of about half a minute of time, the black globe of the moon appears projected far in front of the luminous prominences and the corona, which are, therefore, clearly seen to belong to the sun. Glass transparencies from negatives specially selected for this purpose, and appropriately mounted, would show these phenomena in a very striking manner.

William Crookes.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 2nd, 1869.

Dr. A. W. Williamson, F.R.S., &c., President, in the Chair.

The minutes of the previous meeting having been read and confirmed, the following certificates were read:—

For the first time—James Bell, Howell Hill, Ewell; G. R. Hislop, Gas Works, Paisley; William Ladd, Beak Street, Regent Street; Alfred Bird, Worcester Street, Birmingham; H. Seward, 15, Barnsbury Park, N.; Edwin Lepper, 11, Maiden Lane, Queen Street, Cheapside, E.C.

For the second time—Samuel Jefferson, Secretary to the Yorkshire Board of Education, Woodville Terrace, Woodhouse Lane, Leeds; Clements Higgins, Demonstrator of Chemistry, King's College, London; James John Bourey, Analytical Chemist, 10, Stepney Causeway, E.

For the third time—Matthew H. Cochrane, 108, Paul Terrace, Glasgow; Edward Smith, Practical and Pharma-

ceutical Chemist, Strand, Torquay; Thomas Walton, M.R.C.S., and L.S.A., Lecturer on Chemistry at the Hull and East Riding School of Medicine, Kingston-upon-Hull; G. Manley Hopwood, 22, Grosvenor Square, All Saints, Manchester; John Wiggin, Pharmaceutical and Analytical Chemist, Ipswich; Thomas Gibb, A.R.S.M., Engineer; George Harrison, Analytical Chemist, 26, Havelock Square, Sheffield; Sir Roderick Impey Murchison, Bart., F.R.S., Belgrave Square.

The last-named gentlemen were ballotted for and duly elected.

The first paper read was entitled "*Remarks on some Points in the Nomenclature of Salts*," by H. G. Madan, F.C.S.

The author calls attention to the unsettled state of chemical nomenclature, and the difficulty of teaching the science while hardly two of our text-books adopt the same system of names, and while specimens of so many totally different systems are to be found in our periodicals. He then refers to the terminations to the electro-negative radicles, such as *-ide*, *-ite*, and *-ate*, and suggests that the accepted principle of indicating the amount of oxygen in the radicle by a change of a vowel in the name might be extended, so as to embrace such substances as chlorine and sulphur, which form, with oxygen, more than two radicles.

To distinguish the several members of each group of salts containing the same electro-negative or electro-positive radicle, the author prefers rather to add a prefix, such as *proto-*, *di-*, *tri-*, *per-*, &c., to the existing generic name for the salts of the electro-negative radicle with which it is associated than to change the termination of the name of the electro-positive radicle into *-ic* or *-ous*, as the prefix requires the least alteration in existing names, and is the more elastic system of the two.

Mr. Madan does not see the advantage of calling radicles by their Latin names, such as *argentic* nitrate or *ferrous* chloride, but if such a system is considered convenient, it should be carried out consistently, by using such terms as *kalic*, *natric*, *stilbic*, *hydrargic*, &c. The system of terminology proposed by Mr. Harcourt,* and adopted by Roscoe and Watts is, in the opinion of the author, more simple, permanent, and yet elastic, than any other.

Professor Attfield thought the chief point about a name should be that it was unalterable. He objected to the use of vowels or of Latin or Greek numerals to express the name of a salt, as their views of the constitution of a substance sometimes changed, and when such was the case, it became necessary to alter the name.

The President said that Mr. Madan's proposal to revert to the use of such terms as *proto-*, *sesqui-*, and *per-* in order to designate the place of bodies which differ in their quantity of oxygen and chlorine in a series, implied that the series was known, whereas we are constantly altering our knowledge of such series. These words had been productive of considerable inconvenience and confusion, and he thought the terminations *-ous* and *-ic* as used by most writers, including Mr. Roscoe and Mr. Watts, were far more convenient. These terminations only denote a kind of difference in the constitution of certain substances: such a difference might be ascertained as a matter of fact. They might find other terms of each series, and a body which was first might become second, but if it contained less oxygen than another, it was correctly distinguished by the termination *-ous* instead of *-ic*. Mr. Madan seemed to think it necessary always to retain Latin words if they were used in certain cases. It was held by some persons that a variety of name was in many cases desirable amongst such compounds as Prussian blue, where iron figured in two capacities. He, the speaker, was not aware that those who advocated the view against which Mr. Madan contended had ever asserted that a Latin name, if used at all, ought universally to be employed; and if English names were insisted on, they would be led into eccentricities not less remarkable than those against which the author contends. Carbon and sulphur were Latin words which, if discarded in favour of the English words, would lead to words like charcoalic oxide and charcoalic acid, and brimstonic acid and brimstonous acid, a change which did not appear to him a very great improvement. It was exceedingly desirable that everybody should bring forward his own impression in the matter, because it was only by general consent that any important system could be established.

Mr. Vernon Harcourt thought the difficulty attaching to the choice of names was inevitable in the present state of chemistry. Either a name must be unsystematic, and merely express one or two facts about the particular substance, *e.g.*, corrosive sublimate; or, if it was systematic, and expressed a relation between the particular substance and others, it must embody a theory not yet definitely established. With reference to English and Latin names, sulphur had for so long a time been used as an English word, that it was, in reality, no less so than brimstone. The latter, he supposed, was a German word, and sulphur was, originally, Latin, but it had now become as thoroughly English as any word in the language. With regard to using *ic* and *ous*, he thought that the terminations *proto* and *per* might equally be said to express facts; and it appeared to him that the objection raised by Mr. Madan, that the terminations *-ic* and *-ous* served only for two terms of a series, and that this mode of expression cannot be extended in cases where the series extends beyond two terms was a just one. At the same time, he thought that, where there were two parallel series of salts (such as mercurous and mercuric salts, ferrous and ferric salts), it was a great convenience to have these terms, and "ferrous salts" was, perhaps, a better expression than "iron proto-salts," which Mr. Madan recommended as a substitute.

Mr. McLeod remarked that there was a certain excuse for the use of Latin words, for, in almost all cases, they referred to the symbol.

Dr. Odling said that Mr. Madan spoke of the convenience which occasionally attached to their being able to use such a word as "proto-salts," and to speak of proto-salts in general. It would be a real advantage if all proto-salts were conceived to have the same constitution; but, as the word proto-salts did not express the constitution any more than *-ic* and *-ous*, he could not admit that argument to have any weight in favour of the use of such words as *proto-* and *per-* rather than of *-ic* and *-ous*. He was rather inclined to agree with Mr. Harcourt's observations in defence of the English. Respecting such words as mono-chloride and bi-chloride of mercury, it was quite true that, if they used them, they meant that the one contained double the quantity of chlorine in the molecule to the other, and not merely double the ratio of the mercury and the chlorine.

The President hoped it would not be understood that he insisted on Latin names in preference to the English. When Latin names were more easily modified than English, by all means use them; but, when such was not the case, refuse them. It would not be worth while to employ English words instead of the Latin aluminium, chromium, &c.; and it should not be argued that, because they used English words in some cases, that therefore they must use them in all cases. The whole genius of the English language was at variance with that proposition. They wanted an intelligible principle to guide them, instead of the fixed names, which imply particular theories of the constitution of bodies. With regard to *-ic* and *-ous* only adapting themselves to one term of a series, he conceived that, as long as they had to do with the properties of bodies in chemistry, the difference between acid and basic bodies would be one of the chief things to refer to; and, if the business of names was to recall the chief properties of bodies, he thought it must be an advantage, in describing terms of a series, to use some name to distinguish those which were not acid from those which were.

* Chemical News, vol. xvi., p. 272.

Professor Voelcker said that, in one aspect, uniformity of nomenclature had great advantages; but he was not sure that one and the same chemical compound, having two, three, or four different names, was an unmitigated evil. In teaching chemistry, he would not object to a substance being called by the empirical name, if, by this means, certain properties were fixed upon the mind of the student, by which he became familiar with a certain definite substance. He might afterwards be told to call it by another name, and then by a third; and, when he was once familiar with the real nature of the substance, it was immaterial whether he knew it by one name or the other. By the same combination having different names, the teacher would be able to illustrate the different views entertained by chemists of the constitution of a substance.

The next paper was on "*Results of the Analysis of Sea Water Performed on board H.M.S. Porcupine, July*, 1869," by John Hunter, M.A., F.C.S.

The first part of this paper is devoted to abstracts of papers published on this subject by Darondeau, Aime, Bischof, Hayes, Morren, and Thorpe, given by the author to show that very little has been done in investigating the gases contained in the ocean at any great depth, and that the various experiments had not yielded identical results. To collect the water for his experiments, the author used a large brass tube, attached to the sounding-line. Two valves were placed in the tube, one at the upper end, the other below, but both opening upwards, so that, when descending, the water flowed freely through, but, when drawn up, the pressure of the external water closed the valves, and the sample of the last water which had entered the tube was secured. 800 c.c. were placed in a flask, and the gases determined by boiling, according to the method of Dr. Miller. The amount of organic matter was observed by Dr. Miller's process, and the specific gravity was also taken. Two series of experiments were made. In the first, the specific gravity of the bottom water was rather less than that of the surface; but, in the second series, they were identical. The carbonic acid was found to be in greatest quantity at the bottom; it then diminished a certain amount, and remained pretty constant until within about 100 fathoms of the surface, when it diminished still more. The amount of organic matter was about the same in bottom and surface water.

At the end, Mr. Hunter gives the results of his experiments in a tabulated form.

Mr. McLeod thought that, if the absolute quantity of carbonic anhydride or carbonic acid gas in 100 volumes of water had been given, the results would then have been more comparable, and the relation between sea water and ordinary spring water would be shown. The total quantity of gas in 100 volumes of sea water was much less than he would have expected, and less than is found in ordinary river waters. Thames water, he thought, contained 6 volumes in 100 of the three gases together; while the largest proportion of gas in sea water, according to Mr. Hunter, was only 2·8 in 100. It had been stated that sea water brought from a depth effervesced like soda-water; but that would seem to be almost an impossibility if the quantity of gas obtained was as low as 2·8. It was just possible that, in collecting the water, if there was any pressure in the tube, it would open the upper valve, and allow nearly all the gas to escape; but he (Mr. McLeod) was not in a position to suggest a better apparatus than the one described.

The President thought that, if it were soda-water below, they ought to cork it up before bringing it to the surface; but the results obtained by Mr. Hunter did not agree with the soda-water theory. He did not see that the gas should have any tendency to come off from the water, when there was so little of it there; but the quantities might not, perhaps, have been so great as reports made of experiments would lead one to expect.

The Society then adjourned to the 16th inst.

ROYAL INSTITUTION OF GREAT BRITAIN.

General Monthly Meeting, Monday, December 6, 1869.

George Busk, Esq., F.R.S., in the Chair.

George Henderson Gibb, Esq., William Harbottle, Esq., John Henderson, Esq.; and Henry Musgrave Musgrave, Esq., were elected Members of the Royal Institution.

The following lecture arrangements for the ensuing season were announced:—

Professor Tyndall, LL.D., F.R.S.—Six lectures (adapted to a juvenile auditory), "On Light." On December 28th, 30th, 1869; January 1st, 4th, 6th, 8th, 1870.

Before Easter, 1870.

Professor Humphry, M.D., F.R.S.- Six lectures, "On the Architecture of the Human Body." On Tuesdays, January 18th to February 22nd.

Professor Odling, F.R.S.—Twelve lectures, "On the Chemistry of Vegetable Products." On Thursdays, January 20th to April 7th.

Robert Scott, Esq., M.A., Director of the Meteorological Office.—Four lectures, "On Meteorology." On Saturdays, January 22nd to February 12th.

Dr. Masters, F.L.S.—Two lectures, "On Plant Life as Contrasted with that of Animals." On Tuesdays, March 1st and 8th.

Professor Rolleston, M.D., F.R.S.—Four lectures, "Deductions from the Comparative Anatomy of the Nervous System." On Tuesdays, March 15th to April 5th.

Professor Max Müller, M.A., LL.D.—Four lectures, "An Introduction to the Science of Religion." On Saturdays, February 19th to March 12th.

Joseph Norman Lockyer, Esq., F.R.S.—Four lectures, "On the Sun." On Saturdays, March 19th to April 9th.

After Easter.

Professor Blackie.—Four lectures, "On the Principles of Moral and Political Philosophy." On Tuesdays, April 26th to May 17th.

Professor Tyndall, LL.D., F.R.S.—Seven Lectures, "On Physics." On Thursdays, April 28th to June 9th.

Professor Robert Grant, LL.D., F.R.S.—Seven lectures, "On Astronomy." On Saturdays, April 30th to June 11th.

Professor Seeley.—Three lectures, "On History." On Tuesdays, May 24th, 31st, and June 7th.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

November 8, 1869.

Joseph Baxendell, F.R.A.S., Vice-President of the Section, in the Chair.

The following note was read from Mr. Joseph Sidebotham:—

About fifteen years ago, I had a large cabinet, made of forty-five drawers, to contain shells and carpological specimens, the drawers being made of pencil-cedar. Very soon I found that the resinous vapour from the wood became deposited on some of the fruits and shells, making them appear as if they had been dipped in varnish. Chloroform appeared to be the only solvent, and the specimens were obliged to be washed with it. This became so bad that I had the whole of the drawers removed, and replaced with drawers of bay-wood. Some time afterwards, Mr. Carter advised me to have the cedar drawers sized and papered inside, and a new cabinet made to contain them. Accordingly, he made me one to contain thirty drawers. These drawers were exposed to the air for twelve months, and very well sized inside, and

papered; but the resinous vapour is still deposited on the objects in the drawers as before, and, so far, is a warning to every one never to use pencil-cedar for such a purpose. I should not, however, have thought this matter worthy of mention before the Section, had it not been for the very curious and capricious way in which some objects are coated with this resin, while others are left entirely free, and for which I am totally unable to account. In shells, the genera *Conus* and *Oliva* are never touched by it, nor are *Cyprea* or *Mitra*, whilst *Helix*, *Bulimus*, and *Pecten* are coated over. This is the case when there are specimens of these and other genera in the same drawer. As this deposit is on the genera I have named, and never on the others, it would seem to indicate that the texture of some shells would attract the vapour, and not others; but, in the case of birds' eggs, the very strange manner in which some species are picked out, as it were, and others left, is most remarkable. In the owl's eggs, for instance, the barn owl is always free, while the tawny owl is covered with the varnish, although side by side. The song thrush is never attacked, and the missel thrush always.

Trays exhibiting these peculiarities were passed round for inspection.

GLASGOW PHILOSOPHICAL SOCIETY:

(Chemical Section).

The ordinary meeting of the Section was held on the evening of Monday, December 6th, Mr. William R. Hutton, Treasurer, presiding. Several candidates were proposed for admission, and several others were ballotted for.

The first paper read was entitled, "*Note on the Action of House Sewage on Lead Pipes.*" In introducing it, the author,

Mr. Edward C. C. Stanford, F.C.S., referred to the panic which had recently been shown by the voluminous correspondence in the local papers regarding the alleged impurity of the water used for domestic purposes, and stated that it had revived the old question of the action of the purer kinds of potable water on the lead of the pipes and cisterns. The panic, known locally under the name of "death in the cistern," had been completely allayed by the remarkable unanimity of the reports prepared by Dr. Anderson, Professor of Chemistry, and Dr. Wallace, Analytical Chemist, and backed by an eminent medical authority like Dr. W. T. Gairdner. Notwithstanding, however, that the amount of lead was small, a sufficient quantity had been found in almost all the analyses of the cistern water to show the desirability of avoiding all suspicion of lead contamination, by adopting a constant high-pressure service in iron pipes, and, where they are required, of using cisterns of iron or slate. The author remarked that much attention had, from time to time, been directed to the action of the purer kinds of potable water upon lead; but it was somewhat remarkable that an equally-important and much wider-spread evil of a similar character had escaped notice. He referred to the serious deterioration which lead pipes undergo which are connected with water-closets: and he brought this subject under the notice of the Section in order that some light might be thrown upon the cause of the said deterioration. Dr. Fergus, a Glasgow medical gentleman, had the credit of first directing attention to the subject by tracing a close connection between the deterioration of the soil-pipes and the existence of various forms of low febrile disease in the houses into which, from the degenerated condition of the pipes, sewer gases make their escape. By means of sketches and used-up specimens of soil-pipes, the author showed the nature of the action to which the pipes are subject from long use—the length of time varying from ten to sixteen years. Near the bend of the pipe leading from the closet the upper part becomes coated with a greyish white deposit that can be easily scraped off, and the interior of the pipe becomes pitted; while, exteriorly, the pipe is at first blistered at the parts corresponding to the internal "pits," and in course of time it becomes quite riddled with holes, and quite gnawed away as it were. Mr. Stanford had analysed samples of the deposit from several soil pipes, and had found from 86 to about 93 per cent of the deposit to consist of plumbic carbonate, the other ingredients being calcic carbonate, silica, insoluble plumbic oxide, water, and organic matter. After noticing the chemical compounds which, in solution in water, act readily upon lead, the author said that the deterioration referred to was not due to those substances, inasmuch as they were found in the excreta, whereas the injury to the pipes took place in the air-space of the bend, and not in the water-space in which the "trapping" was effected. It has been remarked by plumbers, that a piece of lime, or newly-mixed mortar, in contact with a pipe, rapidly eats through it, probably by the lime combining with the carbonic acid of the outside film, and so cleaning the lead that the action of the air repeats the process. In the opinion of the author, alkalies would probably have the same effect as lime, and so clean the lead that a moist atmosphere would act on it. The effect of pure water on lead is first to dissolve it as oxide, and then this is precipitated as oxycarbonate, which is very insoluble, pure water only dissolving 1-60th of a grain per gallon. Water free from air does not act on lead; and the author therefore thought the action referred to might be due to the air carried down by the rush of water while the closet was acting, and by the carbonic acid, or by the ammonia of the gases of decomposition acting as a cleaner, the interior of the pipe being always in a moist condition. Mr. Stanford concluded by recommending the discontinuance of lead soil pipes, and the substitution of earthenware syphons and flanged cast-iron pipes.

Dr. Fergus, in opening the discussion, recommended that soil pipes should be ventilated, or that they should be used as the rain-water pipes. He gave some instances, in his professional experience, of the connection between such diseases as gastric fever, diphtheria, &c., and bad soil pipes; and he strongly urged the periodical investigation of such pipes.

Mr. Sutherland suggested that the action might be due to sulphuretted hydrogen or acetic acid; but Mr. Stanford said that plumbic sulphide had never been found in his analyses.

Mr. Anderson believed that nitric acid, resulting from the oxidation of ammonia, might have some influence in producing the injurious effects on the pipes. This view was supported by Mr. Hutton and Mr. Tatlock. The first-mentioned gentleman referred to experience extending over sixteen years, and said that Loch Katrine water is very peculiar, in having an abundance of dissolved oxygen and very little carbonic acid, and that such water rapidly acts on lead, producing oxycarbonate, which is readily soluble in fresh water from the same source.

Mr. Stanford replied that he had never met with nitrates in the course of his experiments.

A vote of thanks was awarded to Mr. Stanford.

A paper was then read by Mr. R. T. Tatlock, F.C.S., "*On the Estimation of Iodine and Bromine, with special reference to the Analysis of Kelp.*" We are compelled to hold over this paper for a week.

ROYAL IRISH ACADEMY.

The general meeting of this society was held on Tuesday, November 30th, Right Hon. the Earl of Dunraven in the chair.

The first business was the election of a president, room of Lord Talbot de Malahide.

Dr. Loyd, Provost of Trinity College, moved that the Rev. John Jellett, F.T.C.D., be elected president. He said that Professor Jellett's high scientific claims were thoroughly known by the members of the Academy, before which body his investigations had been brought. In the higher abstract sciences, Professor Jellett was second to none in this part of the empire, with the exception of one, who had retired, and he combined scientific attainments which were not often found in the same man. Dr. Stokes, in the absence of Dr. Russell, President of Maynooth, seconded the motion. Professor Jellett was duly elected by ballot. This election gives general satisfaction, as it has been felt for some time past that the scientific element in the Academy "has not," as the Earl of Dunraven expressed it, "taken the position that was its right."

Sir WILLIAM WILDE then read a paper upon "*A Collection of Gold, Bronze, and Iron Antiquities Found in Excavations made for the Supplying of Gravel to the City.*" They were supposed to be of Scandinavian origin.

Dr. APJOHN then read a paper "*On the Proximate Analysis of Saccharine Substances.*" In this method, the author makes use of the optical and chemical processes, and thus quantitatively determines the amount of cane sugar, inverted sugar, and grape sugar in a given sample. An extended report of this paper will shortly be given in the CHEMICAL NEWS.

NOTICES OF BOOKS.

The Students' Chemistry; being the Seventh Edition of Household Chemistry, or the Science of Home Life. By ALBERT J. BERNAYS, Ph.D., F.C.S., Professor of Chemistry and of Practical Chemistry at St. Thomas's Hospital Medical and Surgical College, &c., &c. 1869. W. H. Allen and Co.

THE well-known and popular work of Dr. Bernays has, in this new edition, been so completely altered and recast that it is, in point of fact, a new book. The experiment of altering the form of a work which has met with such marked favour from the public is a bold one, but we have no hesitation in predicting that, in the present instance, it will be entirely successful.

The book, in its present form, has no longer the popular and readable character that it formerly possessed; but, on the other hand, it is now, what it never was before, a systematic and complete manual for students. It is very lucid in style and practical in matter. It contains a vast mass of fact simply and accurately stated, and bound together by just as much theory as is necessary for the understanding and remembering of it. The notes with which each chapter is headed are very clear and full, and will assist the labours of the student most materially. The author promises to devote a second volume to organic chemistry and to the theories of the science, and confines the present one to inorganic chemistry.

If this second volume is as good as the first, it will be a very useful book.

CORRESPONDENCE.

COAL DYES IN 1818.

To the Editor of the Chemical News.

SIR,—I read in *Blackwood's Magazine*, for June 1818, p. 339, the following paragraph, which may, perhaps, be interesting to many of your readers:—

"*New Extracts from Coal.*—Dr. Jassmeyer, Professor of Chemistry in Vienna, has discovered the means of extracting from coals two hitherto unknown acids, a resin, a resinous gum, and other elements, which he has employed with surprising success to the purposes of dyeing wool, silk, hair, and linen, and has produced from them red, black, yellow, and various shades of brown and grey. Count von Chorinsky, President of the Aulic Chamber, and many other enlightened judges of these matters were present at these experiments, and testified their entire approbation of this useful discovery."

Can any of our brother chemists inform us whether these products are known at the present day, and under what names?—I am, &c.

T. L. PHIPSON, Ph.D., F.C.S.,
Member of the Chemical Society of Paris.

Analytical Laboratory, Putney, S.W.
November 29, 1869.

MISCELLANEOUS.

University of London.—*Second B.Sc. Examination (Examinations for Honours, B.A. and B.Sc. conjointly).*—Mathematics and Natural Philosophy: First Class. Richard Pendlebury, B.A. (scholarship), St. John's College, Cambridge. Logic and Moral Philosophy: First Class. Matthew Robertson, B.A., New College; Walter William Rouse Ball, B.A., University College. Third Class. Arthur Clarke, B.A., Wesley College, Sheffield; Alfred Milnes, B.A., Manchester New College; James Greaves, B.A., private study; Frederick de Sola Mendes, B.A., University College; and Stephen Peter Hayes, B.A., Stonyhurst College, and Henry Keatley Moore, B.A., private study (equal). (*B.Sc. only.*)—Chemistry: First Class. Alexander Muirhead, University College. Second Class. Charles Thomas Whitmell, St. John's and Trinity Colleges, Cambridge. Geology and Palæontology: First Class. Charles Thomas Whitmell, St. John's and Trinity Colleges, Cambridge; Frederick Antony Potter, Royal School of Mines. Zoology: First Class. Phineas Simon Abraham, Trinity College and Royal College of Science, Dublin. Second Class. William Henry Johnson, University College.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, November 29, 1869.

This number contains the following memoirs and papers relating to chemistry and allied sciences:—

Construction of an Optical Plane.—M. Foucault.—It appears that M. A. Martin has found, among the papers left by the deceased author, a short note on the proper means to realise the construction of an optical plane—that is to say, a plane surface so perfect that the reflected ray of light in no respect differs from the incident ray.

Improving Wine by Electricity.—M. Scoutetten.—The author states that the accidental striking of lightning on the house of a vineyard proprietor caused the rupture of several large hogsheads containing wine, which found its way into a cavity existing in the cellar of the house. The owner imagined his wine lost and spoiled, but found, to his astonishment, that the wine, instead of having been deteriorated, had become better than it was before. This accidental occurrence having come to the knowledge of General Marey-Mouge, caused the author of this paper to be consulted, and a series of experiments were instituted with various kinds of wine, of inferior as well

as medium quality, the result being that a galvanic current, applied to the liquid in the casks, both electrodes consisting of platinum plates, eminently improves even very inferior kinds.

Rendering Rivers Wholesome.—M. Gérardin.—According to this author, the fouling of rivers and water-courses is greatly due to the starch manufactories situate along the same, in consequence of the discharge of water containing up to 7 and 8 per cent of albuminous matter, which soon enters into decay, giving rise to the formation of myriads of lower forms of animal life, which withdraw from the water its dissolved oxygen, and hence cause the destruction of higher organised plants and animals.

Researches on Solar Radiation.—MM. Desains and Branly.—This paper, and the following—

Expansion of Gases—M. Moustier—Are not well suited for useful abstraction.

Molecular Action in Atmospheres of Chlorine, Bromine, and Iodine.—M. Valson.—This memoir contains the results of a series of experiments relating to the capillary action of chlorides, bromides, and iodides in aqueous solution and immersed in gas or vapour of the haloids above mentioned. The results are exhibited in tabulated forms.

New Method for the Preparation of Anhydrous Nitric Acid.—MM. Odet and Vignon.—The authors refer first, at some length, to the now well-known, yet difficult and highly delicate, method of obtaining anhydrous nitric acid, discovered by M. H. St. Claire-Deville. The authors obtain this compound by causing chloride of azotyl to act upon perfectly dry nitrate of silver at from 60° to 70°. Chloride of azotyl is prepared by the action of oxychloride of phosphorus upon nitrate of lead, or, better yet, nitrate of silver. The chloride of azotyl is a slightly yellow-coloured liquid, boiling at 5°, and not frozen at −31°; in contact with water, this substance is decomposed into nitric and hydrochloric acids. The vapour of this fluid is applied for the decomposition of dry nitrate of silver, in a simple apparatus consisting of U-shaped tubes soldered together by means of suitably-bent glass tubes. The chloride of azotyl is prepared simultaneously with the anhydrous nitric acid, which is collected in a tube placed in freezing mixture at −25°.

Preparation of Hydrate of Chloral.—M. Roussin.—The mode of preparation here described is precisely the same as that already well-known, and lately quoted by us from a German paper. Pure hydrate of chloral is a snow-white crystalline substance, not exhibiting any smell at the ordinary temperature of the air; it volatilises slowly, without absorbing much moisture, unless it be placed in a very damp place; fuses at 56°; boils at 145°; is completely soluble in a small quantity of water, and also soluble in alcohol, ether, chloroform, sulphide of carbon, benzine, and fatty substances. Its aqueous solution ought to be neutral to test paper, and ought not to become turbid by a solution of nitrate of silver. When, to this aqueous solution of hydrate of chloral, a few drops of a solution of caustic potassa are added, there is formed chloroform, easily recognised by its peculiar smell.

So-called Inverted Sugar.—M. Dubrunfaut.—There is appended to this paper a short foot-note, from which it appears that there belong to it two papers not printed yet, by M. Maumené, without which this subject is not complete.

Radiation from the Moon.—M. Marié-Davy.—A third memoir on the much-vexed question about the heat given off by our satellite. This memoir is a purely mathematico-physical essay.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 16, 1869.

The president, Dr. A. W. Hofmann, opened the ordinary meeting, from the *procès verbal* of which we learn the following items:—Among the ordinary members elected, we find the name of Prof. Chandler, of New York. Prof. Baumhauer, of Haarlem, promises to send to the Society a regular account of all that is done on chemical territory in the Netherlands. The president exhibits several samples of partly crystallised tin, received from M. Fritsche, of St. Petersburg; this crystallisation is the effect of a continued exposure for three hours of the metal to a temperature below the freezing point of mercury. When the metal is exposed for any length of time to this low temperature, it falls completely to a greyish coloured powder; when this powder is heated to 100°, it becomes whitish-grey coloured. The president exhibits several photograms representing partially-crystallised organ-pipes, which had been inspected and photographed by the late Prof. Erdmann. We may mention here that this crystallisation of the tin whereof organ-pipes are made is by no means an uncommon phenomenon, and one not solely due to cold alone, but, in a great measure, to the vibration these pipes are subject to. The president exhibits a number of samples of wool, dyed green with the so-called iodine green, by M. T. Peters, of Chemnitz, and hands round to the members circulars issued by that dyer, and printed in German, French, and English, on the best method of applying this dye.

Preparation of Hydrate of Chloral.—MM. Müller and Paul.—The chief part of this operation consists in passing a current of dry and pure chlorine gas into pure and absolute alcohol, until the contents of the flask are, after about 70 hours, converted into a white and crystalline mass; when this operation is properly conducted, a large quantity of hydrate of chloral is obtained. The authors state that they had found by experiment that the hydrate of chloral is readily sublimed, and may be thus obtained as a dry, snow-white, neutral crystalline powder.

Relation of Mercury-Phenyl to the Aromatic Series.—MM. Dreher and Otto.—Mercury-phenyl is formed by the action of $HgNa_2$ upon C_6H_5Br—

$$2(C_6H_5Br)+HgNa_2=\left\{\begin{matrix}C_6H_5\\C_6H_5\end{matrix}\right\}Hg+2NaBr.$$

The addition of a small quantity of acetic ether greatly promotes the reaction. ClH, IH, and BrH decompose—

$$\left\{\begin{matrix}C_6H_5\\C_6H_5\end{matrix}\right\}Hg,$$

according to the following equation:—

$$\left\{\begin{matrix}C_6H_5\\C_6H_5\end{matrix}\right\}Hg+2HCl=HgCl_2+2C_6H_6.$$

By the action of chlorine, bromine, and iodine, it is not easy to obtain from mercury-phenyl the respective chlorinated, bromated, and iodated compounds; the reactions and decompositions which take place are represented by the following formulæ:—

$$\left\{\begin{matrix}C_6H_5\\C_6H_5\end{matrix}\right\}Hg+2Cl=\left\{\begin{matrix}C_6H_5\\Cl\end{matrix}\right\}Hg+C_6H_5Cl;$$

when chlorine was made to act upon—

$$\left\{\begin{matrix}C_6H_5\\Cl\end{matrix}\right\}Hg+2Cl=C_6H_5Cl+HgCl_2.$$

We refrain from further abstraction of this lengthy paper, which is chiefly composed of a mass of formulæ.

Phosgene.—MM. Emmerling and Lengyel.—This paper is divided into three sections:—(1) *Conversion of carboxysulphide into phosgene.*—Chlorine does not act upon carboxysulphide at the ordinary temperature; but when a dry mixture of both gases is made to pass through a red-hot porcelain tube filled with fragments of broken porcelain, a gaseous mixture of CO, $COCl_2$, SCl_2, and unchanged Cl and COS. In order to recognise the phosgene, and estimate its quantity, the gaseous mixture just alluded to was passed through tubes filled with black sulphuret of antimony, this serving the purpose of separating the phosgene from various admixtures. For the purpose of analysis, the gas was collected in tubes, inside of which a small glass globe was placed, filled with a solution of caustic potassa. After the tubes had been filled with the gas, and sealed, this glass globe was broken (its walls being very thin), by shaking the tube in the fluid contents. After a time, the relative proportions of Cl and S were determined, and in other portions of the gas the CO was separately estimated. (2) *Preparation of phosgene from chloroform.*—This fluid is split up by the action of sulphuric acid and bichromate of potassa, yielding phosgene—

$$2CHCl_3+3O=2COCl_2+H_2O+Cl_2.$$

Forty parts of strong SO_3, five parts of bichromate, and two parts of chloroform yield, when heated on a water-bath, a phosgene free from oxygen. (3) *Fluid phosgene.*—This was obtained by passing the gas through an U-shaped tube placed in ice. The fluid gas is very volatile, and specifically heavier than water, by which liquid it is decomposed, evolving CO_2.

Under the title of "Correspondence," we meet with a first instalment of a report about the meeting at Inspruck, held in September last. Leaving the excellent and thoroughly German and enthusiastic general account of this meeting, we learn that the chemical section was presided over by Prof. Hlasiwetz, of Vienna, and that eighty-six members regularly attended, while the audience was even rather too large for the large chemistry lecture-room of the University wherein this section met. The following subjects were treated:—

Origin (Entstehung) of Iodoform, and the Applicability of the Formation of Iodoform for Analytical Purposes.—M. Lieben.—Iodoform is, according to this author, the most delicate test for alcohol, provided such substances be absent as might happen to exhibit the same reaction. In ether, even when distilled over sodium, alcohol can be detected by iodoform; and there is no doubt, the author says, that alcohol is formed in all ether which contains or can absorb water. Only those substances which contain CH_3 are capable of forming iodoform.

Modifications of Lactic Acid.—Dr. Wislicenus.—According to the author, there exist three modifications of oxypropionic acid. The lactic acid of fermentation, ethyliden lactic acid, differs from the ethylen lactic acid, and is easily obtained from β iodpropionic acid. The lactic acid of muscles differs from the two alluded to, but is not a chemical individual, since it is made up of ethylen lactic acid and a peculiar modification of ethyliden lactic acid.

Phenicin.—Prof. Bolley.—The substance known as phenicin, a brown colouring dye, also known as phenyl brown, is made by adding phenol to a mixture of nitric and sulphuric acids, and by pouring this mixture afterwards into a large bulk of water, when the phenicin is obtained as an amorphous powder. The manufacture of this preparation has given rise already frequently to serious explosions. The author found that the commercial article, as well as the pure article (phenicin), contains binitrophenol, a brown amorphous substance, which is neither a nitro nor a sulpho compound, and produced, it appears, by the action of sulphuric acid upon binitrophenol.

Proteine Compounds.—Dr. Schwarzbach.—The author states that the differences found by many experimenters, in the reaction of the potassio-platinum cyanide with the proteine compounds, is due to the fact that, instead of the Gmelin salt, that of Quadrat has been applied.

Preparation of Iodine Substitution-Products.—Prof. Hlasiwetz.—To the substance which is to be iodised, peroxide of mercury

is added, and the requisite quantity of iodine is added afterwards. The researches on this subject are not quite complete.

At the meeting of the Russian Chemical Society, held on the 2nd of October (O.S.) last, the following communications were made (communicated by M. von Richter, St. Petersburg):—

Benzimide.—M. Zinin.—The so-called benzimide of Laurent, $C_{28}H_{19}N_3O_3$, which is formed by the action of hydrocyanic acid upon essential oil of bitter almonds, is converted, when heated to from 160° to 180°, into an amide—

$$C_{28}H_{19}O_3N_3 + H_2O = C_7H_6O + C_{16}H_{14}O_4N_2,$$

and into a nitrogenous compound, which is the imide of formobenzilic acid.

Bromocamphoric Acid.—M. Wreden.—When dry camphoric acid is heated with bromine to 120°, monobromocamphoric acid anhydride, $C_{10}H_{13}BrO_3$, is obtained. This substance is nearly entirely insoluble in water, alcohol, and ether, at ordinary temperature; it sublimes at about 60°, but is also partly decomposed at that temperature. When this anhydride is boiled with water, a new acid, $C_{10}H_{14}O_4$, is obtained; this acid is readily soluble in water, alcohol, and ether, crystallises from its aqueous solution, sublimes at 110°, and fuses at 201°. The lead and copper salts of this acid are soluble in water; the soda-salt is a very deliquescent substance.

Valerian Aldehyde and Œnanth Aldehyde.—M. Borodin.—When the two substances just named are heated to 240° in sealed tubes, several products of condensation can be directly obtained; the reaction goes on steadily, water is formed, no resinification takes place, and, on opening the tube, no pressure is experienced. The valerian aldehyde yields, when submitted to fractional distillation, two oily fluids, one of which boils at from 195° to 200°, the other at from 180° to 200°. The analysis of these substances proved the first to be the condensation product of two molecules of aldehyde, from which one molecule of water was expelled; the other substance is a polymer of the last-named.

Atomic Weights.—M. Mendelejeff.—This paper contains a new plan of grouping the elements, according to the numerical value of their atomic weights, in the following manner:—Li, 7; Be, 9·4; B, 11; C, 12; N, 14; O, 16; Fe, 19; Na, 23; Mg, 24; Al, 27·4; Si, 28, and so on; but there is a considerable hiatus between Cl, 35, and the next, Ag, 108. The author points out that this grouping of the elements expresses the law according to which the elements can combine with oxygen.

On Xylidine.—M. Tawildarow.—The author prepared xylidine from isoxylol, which was obtained from coal-tar xylol by boiling that substance with dilute nitric acid. The nitroisoxylol thus obtained was reduced by means of tin and hydrochloric acid, and the xylidine purified by means of caustic potassa; the substance thus obtained is a colourless fluid, boiling at 215°; sp. gr. at 18°, 0·985. The oxalate of xylidine crystallises, and is somewhat soluble in water. When xylidine is submitted to distillation, a solid matter is left, which, on being heated to about 240°, yields a substance soluble in alcohol, crystalline, and fusing at 89°; this is a basic substance containing chlorine; its hydrochloric acid compound has the following composition:—$N(C_8H_8Cl)_3.HCl$. 100 parts of xylidine yielded about from two to three parts of this material.

Polytechnisches Journal von Dingler, second number for October, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Blast Furnaces constructed for the Continuous Flowing Off of Slag.—M. Lürmann.—This paper contains the description of an improved blast furnace for ironworks. From a foot-note added to the paper, we learn that the Old Park Iron Company, Shropshire, have adopted the improvements invented by this author, and are highly satisfied with the results.

Chemistry of the Blast Furnace.—M. Schinz.

Manufacture of Steel for the Use of Rifle Guns and Heavy Ordnance at the Works of M. Cockerill, at Séraing.—M. Greiner.—The author states that, at Séraing (near Liège, Belgium), the following three points are rigorously attended to as regards the manufacture of steel for the purpose indicated:—Purity of product; homogeneity thereof; and the exercise of proper control to ensure these requisites. It appears that this branch of manufacture is attended to in a thoroughly scientific manner, the use of the spectroscope, and of chemical analysis and assays, being matters of daily application. The test for carbon is executed in the following manner:—Of two samples of the same kind of steel, 0·2 grm. are placed in beaker-glasses of fully 20 c.c. capacity, and treated with nitric acid of 1·2 sp. gr.; the glasses are kept for four hours on a water-bath, and heated to 80°. The solutions assume a brownish yellow colour, which is compared with the colour which two other solutions of the same quantity of steel, containing a known quantity of carbon (0·61 and 0·63 per cent), assume after the four solutions have been all diluted with the same quantity of pure water. Suppose the solutions of steel containing known quantities of carbon to be respectively diluted to 252 and 260 c.c., and the solutions of the steel under examination to 142 and 144 c.c., the following calculation will give the required result:—

$$\frac{142 \times 61}{252} = 34{\cdot}33; \quad \frac{144 \times 63}{260} = 34{\cdot}90;$$

therefore the average = 34·615 = 0·346 per cent.

Boiler Incrustation, from Lillschacht, near Pribram.—Dr. Mrazek.—The author obtained for analysis and investigation a quantity of a very white, compact, micro-crystalline substance, which was stated to be the incrustation found in a steam boiler fed with water pumped from a mine. On being analysed, the stone was found to consist, in 100 parts, of:—Lime, 33·60; sulphuric acid, 47·41; magnesia, 12·26; water, 5·52; impurities, 0·79. This result leads to the formula $2(CaO,SO_3)+(MgO,HO)$, constituting, in fact, a mixture of anhydrite and brucite. The analysis of the water proved it to contain, in 10,000 parts—Sulphuric acid, 5·51; lime, 3·40; magnesia, 0·29; with traces only of chloride of sodium and soluble organic matter. The author also obtained a quantity of mud taken from the same boiler; this mud was found to consist, in 100 parts, of—Anhydrite, 14·84; hydrated magnesia, 2·27; lime, 16·49; carbonic acid, 12·96; clay, particles of quartz, oxides of metals, and metallic sulphides, 30·26; particles of wood and water (the former predominating), 23·78. The author states in this paper that if, in the case of boiler explosions, it is possible to obtain some of the incrustation of the exploded boiler, the analysis of that incrustation may lead to the detection of the cause of the explosion; if due to the want of water, and the boiler-plates becoming red-hot, the exact estimation of the water chemically combined with the incrustation is sufficient, since, if the boiler had been red-hot, the whole of the water of combination will have been expelled.

Apparatus for the Safe Keeping and Transport of Petroleum, Benzol, &c.—Dr. Tech.

Application of Iridium for Staining Glass and China.—M. Frick.—It appears that pure oxide of iridium yields, upon glass and china, a black-coloured stain of so intense and deep a tone of shade that the other substances in use for that purpose are, compared with this colour, of a brownish hue. The pure oxide of iridium is obtained, especially as a bye-product, in the purification of American platinum ores, and may be obtained from M. Rüszler, at Frankfort-on-the-Maine.

Moniteur Scientifique, November 15, 1869.

Artificial Alizarine.—M. Bolley.—There are at present already three artificial products which come into competition with madder and its various preparations, viz.:—(1) It appears that MM. Græbe and Liebermann have stated, at the congress of German *savants* lately held at Insprück, that they can dispense with the use of acetic acid and bromine, and will be enabled shortly to bring into the trade a superior product, made by a method different from that described in their patent, and that this new product will be manufactured at Manheim by a celebrated firm of aniline colour makers. (2) Artificial purpurine and alizarine, made by MM. Broenner and Gutzkow, according to their patent, by the action of protonitrate of mercury upon anthrachinon; this process is carried on at Frankfort-on-the-Maine. (3) Artificial alizarine (alizapurine, according to M. Alfraise), prepared, by a process as yet kept secret, by MM. Meister and Lucius, at Hoechst, near the same city just named. The author of this paper just named states that he received from M. Riese, the head chemist to the firm just alluded to, at Hoechst, a quantity of 500 grms. of the paste (artificial alizarine) in question, with the request to assay it and report thereon. This substance exhibits a greenish brown-coloured, rather fluid paste, containing about 6 per cent of dry solid matter; when this dry substance is cautiously submitted to an elevated temperature, a brick-red coloured sublimate is obtained in needle-shaped crystals, a bulky carbonaceous residue is left, and, on igniting this, the ash is found to contain a large proportion of oxide of iron. The sublimate dissolves in caustic soda, exhibiting a very deep blue-violet colour; this solution yields, by the addition of chloride of barium, a bluish violet-coloured precipitate, which resembles, in a high degree, the precipitate obtained under similar conditions from the alizarine of madder. The ammoniacal solution of the sublimate, and the precipitate formed therein by the baryta-salt, also, resemble the reactions obtained from native alizarine from madder under the same conditions. The sublimate referred to yields, on being boiled with a solution of alum, a partial solution in alum, but the dissolved material precipitates on cooling, and the fluid then exhibits only a rose-red colouration; it would accordingly appear that the sublimate consists mainly of alizarine, mixed with very little purpurine. The results of elementary organic analysis of this substance are quoted as follows, three analyses having been made, and the carbon and hydrogen only put down percentically:—C, 69·23; H, 3·38; C, 66·04; H, 3·28; C, 66·46; H, 3·39. The composition of purpurine, according to M. Schutzenberger, $C_{20}H_{12}O_7$, requires percentically—C, 65·93; H, 3·29. Alizarine dried at 100° is, according to Dr. Schunck, percentically—C, 69·13; H, 4·03; and, according to MM. Bolley and Rose—C, 69·54; H, 3·75. The author infers, from these facts, that the sublimate holds a composition intermediate between alizarine and purpurine; that the first portions of the sublimate above referred to contain more, or, rather, approach more to, alizarine, and the latter portions more to purpurine. On comparing the tinctorial properties of this sublimate with those of alizarine obtained from madder, the following was observed:—(1) In the dry state, the artificial alizarine in question is less suitable as a dye than when it is in paste; (2) its tinctorial power, when dry, is at least equal to one-and-a-half times the same weight of raw (green) alizarine from madder, as prepared by M. Kopp's process; (3) the artificial alizarine dyes mordanted cloth rapidly, but soils the white grounds more than green alizarine; (4) the red is very brilliant and pure after cleansing (*avivage*); (5) the violet assumes, after cleansing, a greyish hue, and the puce and black are excellent. All these colours are fast, and in no way inferior to those obtained from madder. According to the author, the experiments instituted by MM. Alfraise and C. Kœchlin, with the view to prove that the preparation alluded to, and produced by MM. Meister and Co., is neither alizarine nor purpurine—are not made with sufficient care, and with

a too impure material (the paste only) to deserve the required confidence. As regards the tinctorial power of the paste, also, this appears to have been overrated by M. C. Kœchlin.

Dyeing with so-called Iodine-Green Paste on Wool.—M. Kalle.—This author, wholesale manufacturer of artificial dyes at Biebrich (Nassau, Prussia), states that, having read the communication on the process described by M. Peters in the number of the 1st of November last of this periodical, he feels obliged to point out the following defects in that communication:—(1) When the workman does not happen to use great skill and precaution, the green does not completely dissolve in acidulated water; hence there is a loss of colouring matter. (2) When the colouring matter does not dissolve completely, filtration has to be resorted to, which it is best to avoid. The author next gives the following directions, referring, however, to the use of a pure paste only:—The paste is mixed up with one or two parts of cold water (the quantity of water depends upon the state of concentration of the paste; if the latter happens to be very fluid, or, what amounts to the same, poor in colouring matter, the addition of water is unnecessary), from six to eight parts of alcohol are added, and the mixture well stirred up. *Impregnation tincture.*—The dye-bath ought to contain, for 1 kilo. of green in pasty state (price 50 francs, £2), 1 kilo. of silicate of soda of 30 per cent strength, and is brought to the boiling point. When this has been reached, the alcoholic solution of the green above alluded to is poured into the bath, and the wool thoroughly worked through it, without more heating, until the desired shade has been obtained; the wool is next drained, wrung out, and washed in cold water, and then only brought into the developing bath composed as described by M. Peters. The author adds that the developing bath becomes gradually saturated with dye-stuff, and then unfit for use for clear shades of colour; when this point is reached, the liquid is filtered, neutralised with ammonia, a fresh quantity of silicate of soda is added, and the liquid so obtained used as a dye-bath.

Preparation of Victoria Yellow (Binitronaphthol).—MM. Darmstädter and Wichelhaus.—One part of naphthaline is mixed with two parts of concentrated sulphuric acid, and heated on a water-bath until the solution is complete; the sulpho-naphthalic acid so obtained is saturated with soda, and the solution is evaporated to dryness. The sulphonaphthalate of soda is next fused with caustic soda, and the mass resulting from this operation is dissolved in water and supersaturated with HCl, whereby naphthol, or hydrate of naphthyle, is separated. This substance is next boiled with a mixture of sulphuric and nitric acids, yielding binitronaphthol, the yellow colouring matter; this substance is chemically different from, but, after all, isomeric with, the so-called Martius yellow, or binitronaphthylic acid. The formula, $C_{20}H_6N_2O_{14}$, $N_2O_{12}O_8$, answers for both equally well; industrially speaking, both substances approach each other to such a degree that they may be considered identical; both are best used in the state of ammoniacal salt, this being the most readily soluble salt for each. These materials are employed at Paris for the adulteration of gamboge, and very largely used for the colouration of artificial flowers, leather gloves, &c.

Manufacture of Carbonic Acid on the Large Scale.—M. Dietz.—After reviewing several processes in use for this purpose, the author describes, at great length, a process in actual use at Kama, near Tschistopol, Russia. The gist of the description is that the gas given off by a lime-kiln heated with wood is used as a source of carbonic acid for converting carbonate of soda into bicarbonate. During twenty-four hours, 900 cubic metres of carbonic acid gas are consumed, and the combustion of the wood used for heating the kiln is so regulated as to yield a portion of that gas along with that obtained from the limestone; wood, however, in that locality, is almost a waste material, being extremely abundantly found.

Grotto of the Dead.—We notice the title of this paper, which contains a very interesting description of the Baumo das Morts, near Durfort, Departement Du Gard, France. For the study of the earliest age of man's appearance on the globe, this is a valuable contribution.

Journal für Gasbeleuchtung, Nos. 9 and 10, 1869.

These numbers contain the following original papers relating to chemistry and allied sciences:—

What is Good Gas?—Dr. Schilling.—In a lengthy and exhaustive paper, the author reviews this question on all sides, and comes to the following conclusions. A good and suitable gas for artificial illumination ought to possess the following qualities:—(1) The gas ought to possess a normal illuminating power. The exact determination of the value of the normal illuminating power can only be obtained when the gas made from various qualities of coal, and manufactured according to rational principles, is compared, under exactly identical conditions, with the normal standard candle. Any gas which, by a combustion of 5 cubic feet per hour, exhibits a light equal to fifteen spermaceti candles, may be considered a gas of good illuminating power. (2) The gas should be absolutely free from sulphuretted hydrogen. (3) The pressure of the gas at the works and in the leading mains should, as a minimum, amount to from 0·8 to 1·0 of the water-pressure guage.

Researches on the Coals from Saarbrück.—M. Gasch.—A most valuable addition to the chemistry and technology of coals, containing the results of elementary organic analysis, the quantity and quality of gas and coke yielded by each kind of coal, the transportability of the coal (*i.e.*, the resistance against breakage and falling into smalls and dust), carefully determined. The value of coal and coke as fuel, and the exact determination of the illuminating power and durability of the gas, when manufactured on the large scale, according to the best method, including pyrometrical measurement of heat applied to the retorts.

Gas Meter Testing Regulations for the North German Confederation.

Hydrogen and Carbonic Oxide Gas.—M. Schinz.—The author proposes the use of a mixture of equal quantities, by bulk, of these gases, instead of hydrogen only, for illuminating purposes, by means of incandescent platinum. Experiments made prove that the illuminating power of this mixture is, for equal consumption, equal to 1·242, coal gas of good quality being 1·0.

Photometrical Studies.—Dr. Rüdorff.

Contribution to the Purifying Question.—M. Cox.—Under this title, the author discusses and elucidates, by a series of experiments, the action of sulphuretted hydrogen and hydrated peroxide of iron.

Comparison of Various Kinds of Gas in reference to its Cost of Production and Illuminating Power.—M. Sautter.

Zeitschrift für Chemie von Beilstein, No. 21, 1869.

This number contains the following original papers:—

Formation of Glycolamidic Acids.—M. Ziegler.—When a concentrated solution of glycocol and monochloro-acetic acid is boiled with chlorinated diglycolamidic acid, the result is triglycolamidic acid; but since, when glycolic acid and ammonia are boiled with the same substances, neither glycol, nor di- and triglycolamidic acid are formed, the author thinks there is no doubt that, when these acids are prepared from ammonia and monochloro-acetic acid, the one is formed after the other, because an atom of hydrogen bound to one of nitrogen combines with an atom of chlorine of the monochloro-acetic acid.

New Mode of the Formation of α Triphenyl-Guanidine.—MM. Merz and Weith.—Equal molecular quantities of aniline, carbanilide, and one-third molecule of trichloride of phosphorus, yield, when mixed, a solid mass, which, while fusing at 140°, effervesces strongly, and, giving off hydrochloric acid, is converted into a basic substance and phosphorous acid (when carbanilide and aniline alone are heated together to about 190°, no reaction takes place). The basic substance just alluded to is, after having been purified, found to be triphenyl-guanidine, fusing at 143°; its platinum compound contains 19·85 to 20·01 per cent metal. This reaction is represented by the following formula:—

$$\left.\begin{array}{l} N\langle^{C_6H_5}_{H} \\ | \\ 3CO \\ | \\ N\langle^{H}_{C_6H_5} \end{array}\right\} + 3C_6H_5.NH_2PCl_2 = \left\{\begin{array}{l} N\langle^{C_6H_5}_{H} \\ | \\ 3C \\ | \\ N\langle^{H}_{C_6H_5} \end{array}\right. = NC_6H_5 + 3HCl + H_3PO_3.$$

100 parts of carbanilide yield 135·3 parts of this basic substance.

Decomposition of Dichlorobromo-Hydrine by Hydrate of Baryta.—M. Claus.—This paper may be briefly summarised in the following words:—It appears that a dispute has arisen between the author and some other scientific chemists, on the subject of the action of baryta and dichlorobromo-hydrine. Among the products of decomposition, propyl-phycitic acid was found by some of the parties; the author now says that that acid is only glycerinic acid and quadriacid-propyl-phycitic alcohol, formerly supposed by the author to exist, has not had its existence proved with sufficient accuracy.

NOTES AND QUERIES.

Glue and Gelatine.—I would feel obliged if any one would refer me to the memoirs which have been published on glue and gelatine or to any special source of information on these subjects.—G. G.

Utilisation of Sulphate of Lime.—Will any of your readers, through your columns, kindly inform me of some process, or some book which treats of such process, by which the sulphate of lime obtained in neutralising the superfluous acid when making Glauber's salt, can be turned into manure or any other saleable article.—GLAUBER.

Gas and Oil Furnaces.—Your correspondent ("Runcorn") I think, would find creosote do for his purpose; it is used by the Government for melting metal, &c., at Woolwich. The heavy tar oil is burnt in contact with steam, perfect combustion thereby taking place. Should he address himself to me at the Post Office, near Mark Lane, Fenchurch Street, I would give him the necessary information.—R.

Testing Lemon-Juice.—I wish to know what process is followed by analytical chemists in testing concentrated lemon-juice as used by calico printers—viz., to ascertain quantity of citric, tartaric, sulphate, and oxalic acids, chlorides, iron, or any other contaminations contained therein—and should feel obliged if you would, through the medium of your valuable paper, give me the name of some work where I could meet with the information.—A. S.

Bronze for Leather.—Can any of your readers give me the composition of the dye used in giving a rich reddish brown metallic (bronze) appearance to leather? It is altogether a vegetable dye—or, at least, it is either animal or vegetable—because it leaves no residue on combustion. Your correspondent refers to the bronze now so general on ladies' boots and shoes.—A CONSTANT READER.

Reducing the Metal from Impure Chloride of Zinc.—(Reply to "An Old Subscriber.")—Not having stated what are the impurities, it is somewhat difficult to advise on the subject, but perhaps the following plan will answer:—Make a moderately strong aqueous solution of the chloride; add powdered dry chalk in a very slight excess. You thus obtain carbonate of zinc, while chloride of calcium will be in solution. Wash the carbonate of zinc, dry it, and mix it with powdered charcoal and some crude oil, taking care to have excess, by weight, of the former of these substances. Place this mixture in a fire-clay retort, or apply the well-known English zinc-melting method. You will require a very strong heat. The zinc, being a volatile metal, will distil.

Acacia Charcoal.—Japanese Fireworks.—Acacia charcoal is now given as a medicine, sold at a high price, the vendors averring that acacia charcoal, and acacia charcoal alone, is the only efficacious material; in fact, that no other charcoal "need apply." I doubt this. Will any of your chemico-medical readers kindly give me information, or an opinion on the subject.—The pretty little Japanese fireworks, for which I sent you a formula once upon a time, have frequently failed in the hands of my friends. I find the cause to be the enormous degree of adulteration in the flour sulphur; crystallise this from benzol, and all goes well; in this case, an additional part of sulphur is required. Roll brimstone would probably be pure enough. —R. TREVOR CLARKE.

MEETINGS FOR THE WEEK.

MONDAY, Dec. 13th.—Royal Geographical, 8.30.
—— Medical, 8.
—— London Institution, 4.
TUESDAY, 14th.—Photographic, 8.
WEDNESDAY, 15th.—Society of Arts, 8.
THURSDAY, 16th.—London Institution, 7.30.
—— Royal, 8.30.
—— Chemical, 8.
—— Zoological, 4.
FRIDAY, 17th.—Quekett Club, 8.
—— Royal Institution, 8.

TO CORRESPONDENTS.

John A. R. Newlands, F.C.S.—Declined, with thanks. Such purely theoretical speculations occupy more space than we can now spare.

C. R. C. Tichborne.—Received, with thanks.

A Subscriber.—A work on the subject is in the press. It will be announced in these columns.

BOOKS RECEIVED.

The Chemistry of Silesian Sugar-Beets. By Dr. Augustus Voelcker. London: W. Clowes and Sons.

The Life and Letters of Faraday. With portrait and woodcuts. By Dr. Bence Jones, F.R.S., &c. London: Longmans and Co.

The Mechanic. Part 21, for December.

A Manual of Diet for the Invalid and Dyspeptic, with a Few Hints on Nursing. By Duncan Turner. London: John Churchill and Sons.

The Development of the Idea of Chemical Composition. By Alexander Crum Brown, M.D., D.Sc. Edinburgh: Edmonston and Douglas.

Just published, demy 8vo., price 6d.

On English and Foreign Alkalimetrical and Chlorimetrical Degrees, by John Pattinson, F.C.S. Read before the Newcastle Chemical Society.

London: CHEMICAL NEWS Office, Boy Court, Ludgate Hill, E.C.

The Mysteries of Udolpho.—Astounding Effects!! Innumerable Ghosts appear and disappear!! Three emanate from One!! The Scenes by Fid. Beetles crawl the Dungeon.—Occasionally, AMSTERDAM and its EXHIBITION, visited by Professor Pepper.—PECULIAR PEOPLE OF THE PERIOD, By Messrs. Wardroper.—ACCREDITED RELICS of the late MAXIMILIAN.—The GREAT LIGHTNING INDUCTORIUM is being increased in power: the wonder of the age and science.—THE MYSTERIOUS HAND.—PETIT CONCERT, introducing Herr Angyalphi, the justly renowned Basso Profundo, the Misses Campbell, and Herr Schalkenbach on the Electric Organ. —ROYAL POLYTECHNIC.—One Shilling.

In 2 vols., 8vo., with Portrait and Woodcuts, price 28s.

The Life and Letters of Faraday.—By Dr. BENCE JONES, Secretary of the Royal Institution.

London: Longmans, Green, and Co., Paternoster Row.

Just ready, Fifth Edition, post 8vo., cloth.

A Manual of Qualitative Analysis. By Robert GALLOWAY, F.C.S., Professor of Applied Chemistry, Royal College of Science for Ireland.

The author has made this edition a more complete work on Practical Chemistry by describing, in addition to the ordinary reactions, other properties of the metals and their oxides, of the acids and salts; and at the end of each group, and each important division of the work, a series of examination questions on Practical Chemistry have been added. Many of the questions are of an entirely new character. Bunsen's flame reactions, and other new analytical methods, have been added.

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THE CHEMICAL NEWS.

VOL. XX. No. 525.

ELECTRICITY IN PLANTS.

By EDWIN SMITH, M.A.

THERE is a very interesting chapter in Becquerel's smaller treatise (in three volumes) on "Electricity and Magnetism" concerning the electrical phenomena of plants. I was induced, by reading this chapter, to make a series of experiments, with a view to illustrate the author's statements, and, if possible, to throw some fresh light upon an obscure and puzzling subject. I am now going to put together some notes of these experiments, carefully made at the time, in the hope that they may not be without a certain interest to others. The galvanometer employed is a home-made one, but tolerably sensitive. My greatest difficulty has been to depolarise the slips of platinum by means of which I have made the voltaic circuits; but every care has been taken, to the best of my ability, to obviate error arising from this cause, as well as from thermo-electric disturbance.

Experiment 1.—Take the thick, juicy leaf-stalk of the common garden rhubarb, and, having cut off a length of from 4 to 18 inches, apply a square of platinum foil to each end of the piece. Connect, by means of platinum wire, these two plates with opposite terminals of the galvanometer. The needle will be powerfully deflected. Now reverse the position of the rhubarb between its platinum surfaces, connect as before, and the needle will again be deflected, but in an opposite direction. Having previously ascertained how to interpret the movements of the needle, by noticing its behaviour when a voltaic current is produced between zinc and diluted acid, with platinum for negative plate, and transmitted through the coil, you will at once conclude that a current of electricity is passing from that end of the leaf-stalk nearest the root towards the opposite end, nearest the blade of the leaf.

Experiment 2.—Cut off a piece about 3 inches long from the thickest part of the same leaf-stalk. Divide it longitudinally down the middle. Pare off a level slice of the outer cuticle. Lay the platinum slips close to the two flat sides thus provided, and connect with the galvanometer. There will be indicated a current from the outer side nearest the cuticle to the inner axis of the leaf-stalk. If the section is made thinner, there will be a current in the same direction. You may confirm your conclusion, as before, by simply turning over the piece of rhubarb, so as to reverse the current. Experiments 1 and 2 may be tried upon a thick midrib or branch of the same, taken from the leaf-blade, with a precisely similar result. A cucumber acts in the same way.

Experiment 3.—Insert a platinum wire into the lower end of the flower-stalk of peony. Apply foil to one of the large bracts, or to a petal; connect, and observe deflection. A current is detected flowing from the lower end of the flower-stalk to the bract or petal. The same experiment may be tried with a sprig of fresh oak-leaves, or bramble, or chickweed, or bunch of elder-buds, or poppy-flower, or stalk and leaves of poppy. The current always sets from the point nearest to the root towards the organs furthest from the root. If wires be inserted in the pistil of a flower and its stalk, there will be shown a current flowing towards the former.

Experiment 4.—Lay a leaf of the common dock between pieces of platinum foil. Connect the different surfaces with opposite terminals of the galvanometer, and notice the deflection. A current is indicated from the upper to the under surface of the leaf. A leaf of Spanish chesnut or of young elder will give the same result; but, in four experiments on a leaf of sycamore, I got a current from the under to the upper surface, after a momentary current in an opposite direction. I infer, however, that the momentary current was the true one, and that the second arose from polarisation; for I obtained this latter current by merely employing filter-paper dipped in distilled water, and laid between the slips of foil.

Experiment 5.—Twist a piece of wire round the outer cuticle of a young twig of hawthorn. Insert a second wire between the bark and wood, so as to touch the layer of cambium. On completing the circuit, a current will be indicated from the cambium to the outer cuticle. Again: pass a wire into the pith, and a current may be detected taking a direction from the cambium to the pith. Instead of hawthorn, a cutting from a fresh branch of elder, laurel, hedge-mustard, thistle, groundsel, yarrow, or other dicotyledonous plant, may be employed, with, as I have uniformly found, the same effect.

Experiment 6.—Scrape off the outer cuticle of the root of cress. By means of wires, as before, test the direction of the electric currents. They will be found to flow from the outside to the axis of the root, and, again, from the root-stock, or point of junction with the stem, towards the lower tapering end. The same effects are exhibited by the root of cat's-ear, or of thistle. If plates of platinum foil are applied to the flat surfaces made by cutting across the thick and thin ends of a carrot, a current will be found to set from the thick end of this root to the smaller end.

Experiment 7.—Take a bunch of the seeds of sycamore. Dip a samara attached to the stalk near its broader end into one of the mercury-cups, and a samara attached to the stalk at a point nearer the smaller end into the other cup. A current is indicated from the former towards the latter, in strict analogy to what happened in the third experiment. Or a piece of the stalk itself may be bent, and its ends dipped into the mercury-cups. A current will be indicated, having the same direction as before. A cutting from any pliable stem may be tried in this way, and always, so far as my experience goes, with a similar result.

Experiment 8.—Pass a platinum wire through the tubular hollow of a stem of *Poa*, or some other meadow-grass. Twist another platinum wire round the outside, and connect both with the galvanometer. A current will be shown, having a direction from the interior to the exterior surface of the stem in question. Such appears to be the law with the stems of monocotyledonous plants.

Experiment 9.—Make two cuts through a raw potato, one through the centre, another near the outer coat. Apply strips of platinum to the two flat surfaces, and connect with opposite terminals of the galvanometer. A current is shown to be passing from the centre towards the outside. A lemon, treated in the same way, furnished a current from the outside towards the centre. With a turnip, a gooseberry, and a pear, the same result was obtained; but a stalk of asparagus followed the law of the potato. A boiled potato, tested, when cold, by the same method, gave a current from the outside towards the centre, the indication being confirmed by a reversal of the slice between the platinum conductors. But, after moistening a fresh piece of boiled potato with distilled water, a current was obtained from the centre towards the outside—a result confirmed by reversing the position of the slice between the platinum conductors, as in the previous trial. Fresh platinum was employed, to obviate, as far as possible, any error from polarisation.

Experiment 10.—Reduce to a pulp with distilled water some of the meal nearest the coat of a baked potato. Then make a similar pulp of some of the meal at the centre. Having placed a plug of tow at the bend of a U-tube, pour the pulps thus prepared into different limbs. Connect, by slips and wires of platinum, with the galvanometer. In my experiment, a current was indicated from the outer pulp towards the inner pulp, agreeably to the result of my first experiment with a slice of boiled potato. My object was to destroy all vitality in the tuber by

boiling or baking, and to see whether any chemical action might still remain—sufficient to cause a voltaic current when meal from different parts of the potato was made to furnish a voltaic couple.

Experiment 11.—Having procured a garden nasturtium growing in a flower-pot, insert a wire in the fleshy stem, a few inches above the soil. Then thrust a second wire through the small hole at the bottom of the pot into the soil. Connect with galvanometer. The needle is so deflected as to indicate the passing of a current from the plant to the soil in which it grows. Watering the soil made no change in the direction of the current when I performed the experiment. I also stuck the first wire into the stem in various ways and in various parts, always with the same results. At the same time, a current was detected passing from the root end towards the leaf end of the stem, conformably to the rule in other cases.

Experiment 12.—Make a solution of oxygen in distilled water, also a solution of carbonic acid. Pour them into the different limbs of a U-tube furnished with a plug of tow. Insert platinum slips, and connect with galvanometer. There will be a marked deflection of the needle, showing the passage of an electric current from the oxygen to the carbonic acid. Confirm the result by reversing the platinum connectors.

The foregoing series of experiments are enough to set one thinking; but I feel that it would be premature to reason upon them at present, even with the admirable clue afforded by the treatise of M. Becquerel. I should like to compare, for instance, the electrical phenomena of plants in spring and in autumn, to see how far they are affected by the condition and flow of the sap.* In a future paper, I may, perhaps, be permitted to return to the subject, and attempt some *rationale* of the curious order of facts above-described.

ON THE

ESTIMATION OF IODINE AND BROMINE,

WITH SPECIAL REFERENCE TO THE

ANALYSIS OF KELP.†

By R. R. TATLOCK, F.C.S.

The methods for the estimation of iodine and bromine in presence of chlorine that have been devised from time to time are exceedingly numerous, but, in many cases, very unsatisfatory. They generally require either extreme skill and nicety on the part of the operator (a very small error in the manipulation seriously affecting the results), or they are so tedious and inapplicable in most ordinary circumstances as to be of little value. These remarks apply specially to methods that have been described for the estimation of iodine in kelp, in which the presence of bromine is either overlooked or ignored, although its existence would render such methods totally inapplicable.

The object of the following note is to describe a method for the determination of iodine, bromine, and chlorine, in presence of each other, which I have followed for many years, and which has been perfectly successful in the analysis of kelp. It is not intended to supersede other methods, but merely to take its place along with them, its simplicity in the hands of indifferently-skilled chemists rendering it suitable for adoption in the manufacturer's laboratory, a quality which will be valued more particularly in Glasgow—the seat of the iodine manufacture; while, in point of accuracy, it leaves nothing to be desired.

The method, like that of Frederick Field (*Chemical Gazette* for 1857, No. 357), is based upon the wide difference between the equivalents of iodine, bromine, and chlorine; but the mode of procedure is totally different from that of Field, and is not open to an objection which Fresenius has taken to that gentleman's process of determing these three elements. It depends upon the displacement of iodine by bromine, and of iodine and bromine by chlorine. I shall proceed to give the method in detail before referring to its application in the analysis of kelp.

1. The solution containing the iodide, bromide, and chloride, preferably in combination with an alkali metal, is divided into three equal portions, or, at any rate, three equal portions of it are drawn off. To the one, solution of silver nitrate is added in excess, to precipitate the whole of the I, Br, and Cl. The fluid is then feebly acidified with pure nitric acid, warmed, and agitated till the precipitate settles. This is collected on a small weighed filter, washed with hot water, dried as far as possible at 212°, removed from the filter, dried perfectly by heating to incipient fusion, and weighed, the weight of the small portion adhering to the filter being added, and the weight of the whole noted as—

AgI+AgBr+AgCl.

2. Another portion of the solution is transferred to a small basin, and a quantity of pure bromine-water added. The mixture is then carefully evaporated on an open water-bath, more bromine-water being added from time to time, till the escaping vapours no longer turn starch-paper blue on a fresh addition—showing that all the liberated iodine has escaped. To ensure excess, a little more aqua-bromine is added, and the solution evaporated to complete dryness. The dry residue is then drenched with water, and the result heated till again dry: this operation is repeated two or three times, to ensure the complete expulsion of any hydrobromic acid that may have been present in the bromine-water. The residue, which now consists solely of alkaline bromide and chloride, is dissolved in water, silver nitrate added in excess, the solution acidified, and the precipitate collected and weighed in the usual way. It is noted as AgBr+AgBr+AgCl.

3. The last portion of the solution is brought into a small basin, and a quantity of strong chlorine-water added, to effect the liberation of the iodine and bromine. The mixture is then evaporated till all colour is gone, and some more chlorine-water added. If the solution remains colourless, the whole of the iodine and bromine has been expelled, and the alkali metal will exist entirely as chloride. The solution is then brought completely to dryness, after which it is evaporated with a few drops of water two or three times, to expel any hydrochloric or hydrobromic acid. The dry residue is dissolved in water, the solution acidified with pure nitric acid, silver nitrate added in excess as before, and the chloride of silver collected as usual. Its weight is noted as—

AgCl+AgCl+AgCl.

It is obvious that we have now data from which we can calculate the amounts of iodine, bromine, and chlorine present; for, as the equivalent of bromine is less than that of iodine, in the proportion of 80 to 127, the second precipitate, in which the iodine is replaced by bromine, must weigh proportionately less than the first; and, as the equivalent of chlorine is less than that of either iodine or bromine, in the ratio of 35·5 to 127 in the one case, and 80 in the other, the last precipitate must weigh still less than the second, and we can thus, from the observed differences, deduce the exact quantities of the three elements present.

Example:—

1. AgI+AgBr+AgCl	weighed	15·57
2. AgBr+AgBr+AgCl	,,	14·69
3. AgCl+AgCl+AgCl	,,	12·20

Then—

I.		II.		Observed difference.
15·57	−	14·69	=	0·88

Loss for 1 equiv. I.		Observed loss.		1 equiv. I.		I present.
47	:	0·88	::	127	:	2·378

* My experiments were most of them performed last spring.

† Read before the Glasgow Philosophical Society (Chemical Section), December 6th, 1869.

I.		III.		Observed difference.
15·57	−	12·20	=	3·37

But, as a portion of this loss is caused by the replacement of iodine by chlorine, namely,

Equiv. of I.	Loss in replacing 1 equiv. I by Cl.	I found.	Loss accounted for by I present.
127	: 91·5	:: 2·378	: 1·713

Observed loss.	Loss accounted for by I present.	Difference for Br.
3·37	− 1·713	= 1·657

Loss for 1 equiv. Br.	Observed loss on account of Br.	1 equiv. Br.	Br. found.
44·5	: 1·657	:: 80	: 2·978

Then, as the proportion of iodine and bromine are already known, it will be an easy matter to calculate them to iodide and bromide of silver, and deduct their weight from precipitate 1, calculating the remainder (chloride of silver) to chlorine thus:—

I.	AgI.	I present.	AgI.
127 :	235 ::	2·378 :	4·400

And—

Br.	AgBr.	Br. present.	AgBr.
80 :	188 ::	2·978 :	6·998

Then—

AgI..	4·400
AgBr	6·998
	11·398

Then—

15·57 − 11·398 = 4·172

Then—

AgCl.	Cl.	AgCl.	Cl.
143·5 :	35·5 ::	4·172 :	1·032

We had, therefore, present in the solution—

Iodine	2·378
Bromine..	2·978
Chlorine..	1·032

The bromine water may be easily obtained free from chlorine by distilling bromide of potassium in solution with less potassium dichromate than is necessary to expel the whole of the bromine, using, of course, a little hydrochloric acid.

We now come to the application of the above method to the analysis of kelp.

It is quite obvious that this process cannot be directly applied to substances containing I, Br, and Cl, in very different proportions, and consequently it cannot be used for the estimation of these elements in kelp immediately. The following method of treatment will be found to equalise as nearly as necessary the proportions of the three:—

2000 grs. of the kelp are digested in hot water, the solution allowed to settle, and the clear liquor filtered. The residue is boiled two or three times with water, the fluid being filtered in each case, and the residue finally brought on a filter and washed with boiling water. The filtrates and washings are neutralised as nearly as possible with hydrochloric acid, and chlorine gas passed into the solution till the latter becomes of a distinct orange colour, due to the liberation of iodine and bromine.

The fluid is then shaken up with about one-fourth of its bulk of carbonic sulphide, which takes up the liberated iodine and bromine, and carries them in solution to the bottom of the vessel, provided the specific gravity of the kelp solution be not higher than that of the carbonic sulphide. When this is not the case, the solution of kelp may be diluted till the carbonic sulphide sinks.

The bottom fluid, containing the iodine and bromine, is then drawn off by a fine syphon, and shaken up with an equal volume of water and some zinc-filings. The solution is soon decolourised, on account of the formation of zinc iodide and zinc bromide, which pass into the water; and we have thus a watery solution of the two latter salts above, and colourless carbonic sulphide at the bottom. The latter is drawn off by a syphon, and restored to the kelp solution, to which some more chlorine-water is added; and, if a further quantity of iodine and bromine be liberated, the above operations are repeated till the liquor is quite exhausted.

It only now remains to evaporate the solution of zinc salts, divide into three equal portions, and determine I, Br, and Cl as before described.

With regard to the accuracy of the above method, it may be stated that two sets of trials on pure salts gave the following results, 5 grs. of each of the compounds being used in each case:—

Five grs. KI, 5 grs. KBr, and 5 grs. KCl gave—

	grains.
KI	4·97
KBr	4·97
KCl	5·08

Another trial, with the same quantities, gave—

KI	4·96
KBr	4·95
KCl	5·09

These results leave little doubt that the process is accurate and trustworthy, although I do not deny that other experiments are required to establish the method.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 267.)

In the old microscopes, constructed before the introduction of the achromatic principle, the want of light was very evident when any but the lowest powers were used; this soon led to the employment of some means of increasing the intensity of the illumination. The usual plan was to place a lens beneath the stage, which acted like a burning-glass, and allowed the light to be increased to almost any extent. When the microscopic object-glass was freed from the chromatic and spherical aberrations, the increase of illumination following the enlargement of its angle of aperture for a time satisfied observers; soon, however, a larger amount of light was, in some cases, found desirable, and it was usual to employ one of the object-glasses (generally the next lowest to the one in use) to concentrate the light upon the object. This simple contrivance is very effective when nothing else but greater intensity is needed, and a foreign ½ object-glass will make a very good combination for this purpose when suitably mounted. For the next improvement, we are indebted to Mr. Gillett, who added a series of diaphragms; these, in the most improved form, comprised some having marginal as well as central apertures, as it was soon found that the direction of the light had a very important influence. The condenser has since undergone many improvements, each of the three leading opticians modifying it to suit the requirements of their respective instruments. It consists, as now made, essentially of a combination of achromatic lenses closely resembling an object-glass, and fitted with one or more diaphragm plates, which, either separately or in combination, give perfect control over the amount of light admitted and its direction; the details of construction vary

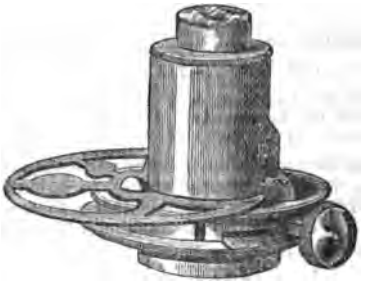
* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January —April, 1869.

somewhat in different condensers. This is mounted beneath the stage of the microscope with suitable adjustments for focussing, and also for placing it truly in the axis of the instrument, or centering. As the instrument is difficult for the beginner to use, it is well to give a few directions.

The first care will be to centre the condenser, as the spot of condensed light is extremely small, and, should the adjustment not be accurately made, the field of the microscope will be only partially, or not at all, illuminated. The simplest way of centering is to screw on a very low power, and view the setting of the top lens of the condenser; it will then be readily seen whether it occupies the centre of the field, and, should it not do so, the requisite traversing screws are moved until it is found to be accurately in the centre. Or the image of a lamp-flame may be formed with the condenser, and viewed with a moderately-low power, and the screws moved until the image occupies the centre of the field. The focus is then to be adjusted by moving the milled head connected with the proper rack, and a suitable diaphragm turned into place. When the achromatic condenser is used, the flat mirror is to be employed, and if a lamp is the source of light, the rays must be rendered parallel, as before mentioned. Some observers use a prism in the place of a mirror, as it reflects more light, and of a purer quality, than a silvered glass, which gives a reflection from its upper as well as its silvered lower surface, which is likely somewhat to interfere with the perfect illumination of delicate objects. Although the most intense light is obtained when the condenser is accurately in focus, it is sometimes preferable to use the condenser somewhat out of focus; for this, as well as the choice of diaphragms, no particular directions can be given, as much depends upon the nature of the object to be viewed, construction of the instrument, and many other circumstances. A little practice, with the help, if attainable, of an experienced microscopist, will be found the best means of mastering the use of this rather difficult instrument. It is an instructive exercise to place a suitable object upon the stage—a Diatom, for instance—and notice the changes in appearance produced by altering the focus of the condenser and using different diaphragms; so varied are the kinds of marking produced on some of the *Diatomaceæ* by changes of illumination, that it would hardly be believed that the object was the same. It is now tolerably certain that the striæ, or lines, whether single or crossed, and the dots, seen on some of these objects, are non-existent, being merely the optical rendering of closely-packed transparent hemispheres. These were observed some years ago by Mr. Wenham, with a 1-50th objective of his own construction, and quite recently by a new and comparatively simple means of illumination discovered by the Rev. J. B. Reade, and described by him in the *Monthly Microscopical Journal* (1869, vol. ii., p. 5). The instrument used is an equilateral triangular prism, which is so adjusted as to reflect an oblique beam of parallel rays. With this illumination, the hemispheres on *Pleurosigma formosum* may be seen with a power so low as a $\frac{1}{3}$, provided the angle of aperture be sufficient. This simple illuminator may probably be of great value for other purposes, besides viewing the surfaces of *Diatomaceæ*; at present however, it has been so short a time in use, that its full capabilities have not been tested.

More recently, a condenser, constructed on a different principle, has been introduced, the optical portion closely resembling the Kellner eye-piece, instead of following the usual pattern, which is derived from the object-glass. This condenser (Fig. 31), now well-known as the "Webster," is a most efficient

Fig. 31.*



instrument, and, from the simplicity of its construction, is capable of being adapted with advantage to small microscopes. The amount of light given by it is considerable, so great that with the full aperture it is almost more than the eye can bear; this excess of light, if it can be considered as a fault, is certainly a good one, as it permits a very extensive use to be made of diaphragms. The graduating diaphragm (Fig. 32)

Fig. 32.*

can be applied to the Webster condenser with the greatest advantage, and its effect is much more marked than when merely used below the stage to control the illuminating pencil from the mirror. The wheel above the graduating diaphragm consists of a series of central and lateral stops, by the use of which a great variety of oblique and dark field illumination can be obtained; the latter far more efficiently than by the use of the ordinary spotted lens. Recently, a revolving carrier for additional diaphragms has been added to this condenser. It consists of a tube sliding into the lower part of the condenser, and provided at its upper extremity with a contrivance for holding a disc of card or thin brass, in which one or more apertures may be cut. By turning the diaphragm-holder round, the oblique pencil may be directed from any azimuth, and the effect on such objects as the *Diatomaceæ* is very marked indeed, the striæ appearing and disappearing as the aperture is moved to, or away from, the proper angle for bringing them out. This contrivance also allows the observer to try any forms of stop he may consider advantageous, as they may be quickly cut out of a piece of blackened card (B. W. Richardson, *Quarterly*

* For these woodcuts we are indebted to Mr. Collins, of Great Titchfield Street

Microscopical Journal, vol. vi., pp. 10, 86). The long focus and large field of the "Webster" render it particularly useful for the general purposes of the student, as it will work into some depth of water, and can be used for illuminating the interior of the troughs so frequently employed in observing living aquatic animals and plants. Although surpassed by the more costly instruments for the most refined description of illumination, it possesses merits peculiarly its own, and no single piece of apparatus can be made to perform so great a variety of offices as this very useful condenser.

The most useful forms of illuminating apparatus have now been described; there are many others, chiefly meant for special purposes—they will be found in the works of Quekett and Carpenter, and the pages of the *Microscopical Quarterly* and *Monthly Journals*, to which the student is referred for descriptions and figures.

(To be continued).

ON THE

CONSTITUTION OF THE COMPOUNDS OF SODIUM.

By J. ALFRED WANKLYN, F.C.S.

Some degree of astonishment was expressed when, having discovered that ethylate of sodium and acetic ether give alcohol and an isomer of butyrate of soda, exhibiting a cleavage into alcohol and acetic acid, I did not follow the usual practice of regarding sodium as monatomic, but formulated the new compound as containing a triatomic metal. One of my chemical friends, who appeared to be unable to contain himself, pointed out to the Chemical Society of Berlin that my new compounds could be represented in the ordinary way, and, in accordance with this notion, formulated them as compounds of sodinated-ethyl, wherein the metal, regarded as monatomic, had replaced an equivalent of the hydrogen which, in union with carbon, constituted ethyl in the original compound.

I will, on the present occasion, adduce a reason which will be regarded as decisive against the ordinary formula. If the new compound were really a salt of sodinated-ethyl, it should admit of the replacement of its sodium by ethyl, and, as the result of such an operation, should give acetate of ethylated-ethyl (*i.e.*, acetate of butyl). Now, nothing of the sort takes place. Iodide of ethyl, which is the proper reagent for effecting such replacements, does not produce iodide of sodium and acetate of butyl when it is made to act on my new isomer of butyrate of soda. Neither does the "absolute ethylate of sodium" (which my Berlin friend would write as hydrate of sodinated-ethyl) produce butylic alcohol by a similar treatment. The absence of such transformations, and the actual course taken by the action of the iodide of ethyl on these substances, are, to my mind, conclusive against the formulæ which my chemical friends wanted me to assign to the new isomers of the sodium salts of the fatty acids.

Furthermore, I am unacquainted with any really cogent reason for assigning to sodium a mono-valent function, even in the common, every-day sodium compounds. As yet, no vapour density determination has been made of any compound of sodium. Some nine or ten years ago, in a paper urging the di-valent nature of zinc and mercury, I pointed out that no metallic chloride, or other metallic compound, had been shown to present only one atom of chlorine or other representative of hydrogen in the standard, two volumes constituting the vapour-unit to which vapour densities are referred. The same remark holds good to-day; and, most probably, when chemists have taken the vapour density of common salt, there will be found two atoms of chlorine in the vapour unit.

The facts of the evolution of hydrogen when sodium acts upon water, of double decompositions taking place between salts of sodium and salts of other metals, are not more in accordance with the view that the metal is monovalent than with other views.

On the other hand, the researches in which I have been engaged have constantly exhibited the polyvalency of sodium. I do not know any chemical compound which shows a greater tendency to enter into double compounds than does absolute ethylate of sodium. With HCl, C_2H_3OCl, H_2S, and C_2H_6O, it forms double compounds. With CO_2, it combines, forming a double compound. With NH_3 and CO, there is no action at all, even at 200° C.—neither combination nor reaction to yield separated products. Iodide of ethyl alone (and even this is a doubtful point) may possibly react without preliminary formation of a double compound.

Now, this constant tendency to form doubles is the criterion of polyvalency. Oxygen was regarded as divalent mainly because there are double oxides of the alcohol radicles and no corresponding double chlorides.

The following is a list of compounds wherein the trivalent character of the metal is apparent:—

1. Double compound of sodium-ethyl and zinc-ethyl .. .. $Na'''\begin{cases}(ZnC_2H_5)'\\C_2H_5\\C_2H_5\end{cases}$
2. Sodium-triacetyl .. .. $Na'''\begin{cases}C_2H_3O\\C_2H_3O\\C_2H_3O\end{cases}$
3. Absolute ethylate of sodium .. .. $Na'''\begin{cases}O\\H\end{cases}C_2H_4$
4. Double compound of absolute ethylate with hydrochloric acid $Na'''\begin{cases}(OC_2H_5)'\\H\\Cl\end{cases}$
5. Double compound of absolute ethylate with sulphuretted hydrogen .. .. $Na'''\begin{cases}(OC_2H_5)'\\H\\(SH)'\end{cases}$
6. Double compound with chloride of acetyl .. .. $Na'''\begin{cases}(OC_2H_5)'\\C_2H_3O\\Cl\end{cases}$
7. Acetate of ethylene-sodium .. .. $Na'''\begin{cases}O\\C_2H_3O\end{cases}C_2H_4$
8. Valerianate of ethylene-sodium .. $Na'''\begin{cases}O\\C_5H_9O\end{cases}C_2H_4$
9. Benzoate of ethylene-sodium .. $Na'''\begin{cases}O\\C_7H_5O\end{cases}C_2H_4$
10. Absolute amylate of sodium .. $Na'''\begin{cases}O\\H\end{cases}C_5H_{10}$
11. Acetate of amylene-sodium .. $Na'''\begin{cases}O\\C_2H_3O\end{cases}C_5H_{10}$
12. Valerianate of amylene-sodium .. $Na'''\begin{cases}O\\C_5H_9O\end{cases}C_5H_{10}$

All of these bodies have been actually obtained, and will be found mentioned in my papers. In order to form an adequate idea of the numerical strength of this material, it should be borne in mind that the examples on the above list have, to a great extent, the character of typical cases. Thus, Nos. 7, 8, 9, 11, and 12 are members of one class whose numbers are very moderately computed at ten thousand. And it should, also, not be forgotten that there has, as yet, been no general movement among chemists in search of double sodium compounds, but that search has been confined to one solitary chemist.

It will be observed that, although I continue to look upon sodium as tri-valent, yet that some alteration has been made in the formulæ of absolute ethylate of sodium, and of the isomers of the sodium-salts of the fatty acid. At first, I wrote—

$$Na''' \left\{ \begin{matrix} (C_2H_4)'' \\ OH \end{matrix} \right.$$

now I have transferred the oxygen from the hydrogen to the ethylene, and, in place of regarding sodium as two-thirds saturated with ethylene and one-third with hydroxyl, I now regard sodium as one-third saturated with oxygen, one-third with ethylene, and one-third with hydrogen.

Adopting this modification of the formulæ, the various metamorphoses of the compounds may be exhibited with great simplicity and regularity. In particular, the reaction between iodide of ethyl and acetate of ethylene sodium (at first sight one of formidable complication) becomes regular and intelligible when viewed in the light of the new formulæ; it consists in the production of iodide of sodium, alcohol, and caproate of acetylinated ethyl:—

$$Na''' \left\{ \begin{matrix} OC_2H_4 \\ | \\ (C_2H_3O) \end{matrix} \right\} Na''' \left\{ \begin{matrix} OC_2H_4 \\ | \\ (C_2H_3O) \end{matrix} \right\} + 2C_2H_5I =$$

$$= Na_2I_2 + \left\{ \begin{matrix} C_2H(C_2H_5)_2O \\ | \\ OC_2H_4(O_2H_3C) \end{matrix} \right\} + OC_2H_4H_2.$$

In the above list, sodium has always been written as tri-valent; it is, however, right to add that I am prepared to consider the metal as being five-valent in the double compounds of ethylate of sodium with hydrochloric acid, sulphuretted hydrogen, and chloride of acetyl. I have, on other occasions, contended that sodium is seven-valent in the crystalline compound of the ethylate with three molecules of alcohol. As will be gathered from my various papers on this subject, I regard sodium as never *monovalent*, but as tri-, five-, seven-valent, and perhaps even higher. This paper has been restricted to organic compounds; on another occasion, I propose to exhibit the inorganic compounds of sodium in a new light.

London, December 11th, 1869.

ON SOME

TECHNICAL APPLICATIONS OF THE SPECTRUM MICROSCOPE.*

By H. C. SORBY, F.R.S., &c.

(Continued from p. 280.)

On the Age of Dark Wines.

IN order to obtain good results considerable care is required, and after trying several methods I found the most satisfactory was as follows:—I have two experiment cells one inch long, made from stout tube, having an internal diameter of about a quarter of an inch. Both ends are cut square, and one is fastened to a piece of glass like a microscopical object by means of purified gutta percha. This I find a most valuable cement for such purposes, since it resists the action of alcohol, acids, and alkalies. The glass must be heated until the gutta percha is sufficiently soft. One of the tubes is carefully graduated into ten equal parts, and the other left plain. Wine in its natural state is often much too dark coloured to enable us to recognise the effect produced by adding sulphite of soda, when we examine the spectrum of the thickness of one inch. It is, therefore, requisite to dilute it with so much of a mixture of one part of alcohol with three of water that the spectrum of the light which has passed through the experiment cells may show a strong, but by no means complete, absorption of the light in the yellow and in the yellow end of the green. After diluting some of the wine to this extent, and adding so much citric acid that it may have a very strong acid reaction, it should be poured into two test-tubes, powdered sulphite of soda dissolved in one, and the other kept without. Though the sulphite may produce a very considerable change at once, the alteration is not complete for awhile, and therefore it is best to keep the solutions for an hour or two in the tubes, corked up to prevent evaporation. The point to be then determined is, how much less thickness of the diluted wine to which no sulphite has been added will give exactly the same intensity of absorption in the yellow, and in the yellow end of the green, as the thickness of one inch of the same acted on by the sulphite of soda. The ungraduated tube should, therefore, be filled with the latter, and a small piece of thin glass placed on the top, so that the light may pass through exactly one inch in thickness of the liquid, and none run out when the tube is placed in an inclined position on the side stage of the spectrum eye-piece. The diluted wine should then be introduced into the graduated tube, which is placed nearly vertically on the ordinary stage of the microscope, and the depth of the liquid carefully regulated by means of a pipette, so that the intensity of the absorption in the two spectra may be exactly the same in the yellow and in the yellow end of the green. The light must be of the same intensity in both spectra; and, therefore, it is also particularly necessary so to regulate the instrument that the transmitted red rays may be of exactly the same brilliancy. The accuracy of this experiment is limited by the difficulty of recognising when the transmitted and the absorbed rays are equal in both spectra, and by its being difficult to determine the depth of the diluted wine to less than 1-100th of an inch. The actual value of the measurements varies, to some extent, according to the manner in which the experiments are made; and, therefore, I strongly advise any one who may wish to employ this method to prepare for himself a table of the comparative amount of change of wines of various ages.

When sulphite of soda is added to a faded solution of the colouring matter of fresh dark grapes it is changed to a pale orange yellow, which colour is, I believe, due in great measure, to the presence of the same yellow substance as is met with in green grapes, so that the intensity of absorption is reduced to about 1-10th, or from 1·00 to 0·10. In the case of the perfectly new wine prepared by myself, the intensity of absorption was reduced from 1·00 to about 0·22. My experiments with the wines of commerce were chiefly made in April, 1868. The newest port wine that I was able to examine was of the vintage of 1866, and therefore about one year and a half old, and even this contained a good deal of the C colour. I examined several specimens of the same vintages of various older dates, which differed considerably in general colour and character, but when all had been kept for the same time in the casks I did not find any material difference in the general results. From the manner in which the experiments were made, the change produced by adding the sulphite of soda is referred to the amount of the C colour taken as unity; and, assuming that the extent to which the wine has been altered by keeping is the difference between the amount still unchanged and unity, the numbers given indicate the relative changes produced by the slow action of the air, but they can only be looked upon as expressing the rate of one particular kind of change. The following table has been constructed from the whole of my observations, so as to give a good general illustration of the subject.

Column 1 shows the age of the wine in years and the date of the vintage.

Column 2 gives the thickness of the diluted wine without sulphite, which produced the same intensity of absorption as 1·00 inch of that to which the sulphite had been added.

Column 3 shows the difference between the values in column 2, divided by the number of years between each

* Communicated by the author, having been published in the *Quarterly Journal of Microscopical Science*, vol. ix., new series, p. 358.

two, so as to exhibit the amount of change for each year, after the wine had been kept for the various periods:—

I.		II.	III.
0	(Made by myself)	0·22	
			0·2700
1½	(1866)	0·63	
			0·0700
2½	(1865)	0·70	
			0·0300
3½	(1864)	0·73	
			0·0200
4½	(1863)	0·75	
			0·0150
5½	(1862)	0·76½	
			0·0150
6½	(1861)	0·78	
			0·0070
9½	(1858)	0·80	
			0·0030
16½	(1851)	0·82	
			0·0020
20½	(1847)	0·83	
			0·0008
33½	(1834)	0·84	
			0·0007
47½	(1820)	0·85	

Since the above table does not refer to wines of even years of age, I subjoin below another derived from it by laying down the results on paper as a curve, and interpolating by careful measurements:—

I.	II.	III.
0	0·220	
		0·330
1	0·550	
		0·120
2	0·670	
		0·050
3	0·720	
		0·022
4	0·742	
		0·017
5	0·760	
		0·012
6	0·772	
		0·010
7	0·782	
		0·007
8	0·790	
		0·005
9	0·795	
		0·005
10	0·800	

It will thus be seen that the rate at which the B colour changes into C is far more rapid in the case of new wine, when much of it is present, than after the wine has become older; being, in fact, about ten times as rapid in the first year as in the third, and about 100 times as rapid as in the twentieth. On this account, the difference for each year is at first so considerable that wines of different vintages could easily be distinguished; but after about six years, the difference is so small that it would be difficult, or impossible, to determine the age to within a single year. After twenty years, a difference of even ten years does not show any striking contrast, and the age could not, therefore, be determined to nearer than ten years by this process. However, up to six years I think it quite possible to determine the age to within a single year. I took specimens of various ports from the casks, of different ages up to six or seven years, and labelled them in such a manner that I did not know the age of any, but could ascertain it afterwards by reference. I then made the experiments with great care, and found that, by proper attention to the details described above, I could correctly determine the year of vintage of each particular specimen.

As already mentioned, the change of the B colour into the C is most probably the effect of the oxygen of the air, which appears to act slowly through the wood of the cask; but the relative amount of these two colours is also modified by the deposit of crust. When kept in well-corked bottles, the change does not appear to be the same, and goes on far more slowly. I therefore think it would be scarcely possible to ascertain the length of time that the wine had been in bottles, and am inclined to believe that the amount of change observed on adding sulphite of soda corresponds more closely with the time that the wine had been previously kept in the cask. I have especially observed this in the case of Bordeaux and Burgundy wines. Those of this type which I have hitherto examined seem to contain a larger relative amount of the B colour, when a few years old, than ordinary ports, and in this respect agree with the so-called *natural port*; but the rate of change is greater when they are kept for some years, probably owing to their containing a less amount of alcohol. There is also a greater variation in different samples of the same age than I have met with in port wine, which is probably because the amount of alcohol in such wines varies more in proportion to the total quantity.

It appears, therefore, that the natural colour of dark grapes is changed by oxidisation into the somewhat similar colour found in new wines, and that, by still further oxidisation, this is converted into another entirely different colour, which becomes much paler by further oxidisation. The rate at which these changes take place varies according to circumstances, but, other things being equal, it varies according to the time of the action. Much also depends on the deposition of colour in the form of crust, and after a long time the original dark coloured substance is almost entirely lost, and only an amber colour remains in solution, which behaves with reagents precisely like that in sherry wines.

On White Wines.

The colouring matter of white wines appears to be derived from one of those yellow substances, soluble in water, of which there are several of materially different character in the faded leaves of different kinds of plants, as more fully described hereafter when treating on hops. That met with in the orange-coloured leaves of the beech is a good example. The depth of the colour is made nearly ten times as great by the addition of ammonia, and when dissolved in strong sulphuric acid diluted with an equal bulk of water, oxidising reagents first turn it much darker, and then much paler. When, however, kept for some months dissolved in dilute alcohol it turns to a much darker tint, and then the solution, with excess of ammonia, is only twice as dark as when made acid by citric acid. Oxidising reagents added to the solution in sulphuric acid do not make the tint any deeper, and thus it appears as if it had been changed by oxidisation into an entirely different colour. The character of this change agrees with what occurs when the colour of dark grapes is oxidised, as already described; and both are good examples of what appears to be a general law. If not already oxidised, a certain amount of oxidisation causes the absorption to advance towards the red end of the spectrum to an extent varying according to the position of the original absorption, and then a still further oxidisation causes the absorption to recede from the red end to considerably beyond the original position, sometimes so much so that all colour is lost. We might thus say that such substances may occur in an unoxidised, in an oxidised, and in a per-oxidised condition. These and similar facts seem also to show that there is an intimate relation between the chemical changes and the particular rays of light absorbed by such substances; but the discussion of this very interesting question would lead me far away from the more immediate subject of this paper.

On comparing the colour of sherry wine with that produced by the action of the air on a solution in dilu-

alcohol of the substance in faded beech leaves soluble in water, I was unable to discover any difference, and hence I think we may conclude that it is formed by the oxidisation of the yellow colour of the grapes; but in some wines it is imperfectly oxidised, and they turn darker when exposed to the air.

(To be continued).

NOTICES OF BOOKS.

The Life and Letters of Faraday. By Dr. Bence Jones, Secretary of the Royal Institution. London: Longmans, Green, and Co. 1870. 2 vols., 8vo., with illustrations.

I.

We all remember the terse and pregnant account of the life of Faraday which appeared last year in the *Proceedings of the Royal Society*, and which was written by Dr. Bence Jones. Here we had the broad outlines and main incidents of Faraday's great career; in the work before us we have the details of the picture, the delicate tintings, and careful finish—we have the details of Faraday's life, together with the more prominent incidents which were before known to us. The present "Life" is almost an autobiography; Faraday's letters are frequently quoted *in extenso*, and his manuscripts and journals have been freely consulted. Dr. Bence Jones had at one time hoped that the journals which Faraday wrote when abroad would have been published separately, when, as he remarks, "some portions of his biography would have been in his own handwriting; but it was thought undesirable to divide the records of the different parts of his life."

The principal facts connected with the life of Faraday have been previously enumerated in this journal and elsewhere; we shall assume, therefore, that it is unnecessary to bring before our readers any specially-connected biography, but shall rather content ourselves with noticing here and there some of the less-known phases of a life which we all admire so profoundly, and all so desire to emulate. The desultory character of this notice, therefore, arises from the belief that we have already in our minds, to a greater or lesser extent, a biography of the greatest natural philosopher of our epoch.

In reading Faraday's first letters to Mr. Abbott, which were written when he was twenty years old (1812), we cannot fail to be impressed, not by the amount of knowledge which he had acquired, so much as by the amount of thought which he had exercised. He had already read largely, and had not confined himself by any means to scientific works, but was evidently well acquainted with many of the classics of English literature. These letters are long, somewhat verbose, and decidedly more turgid in style than his later letters; in fact, we notice as we proceed a gradual assumption of that charming simplicity and clearness in writing which all his later compositions possess. An inflated style is the common error of young writers, and it is more often noticed at one certain period of a career, when the writer has rapidly and almost abnormally, so to speak, acquired learning and a taste for expressing his own ideas, than when it has been more gradually amassed, or to a less degree. Faraday had an early opportunity of lecturing, for he joined the City Philosophical Society in 1813, and it was the duty of each member, in rotation, to deliver a lecture. At this time, also, he was in the habit of meeting a few of his more intimate friends for purposes of mutual improvement; they "met of an evening to read together, and to criticise, correct, and improve each other's pronunciation and construction of language."

Shortly after his engagement at the Royal Institution, Faraday wrote several letters to his friend Abbott, on the subject of lecturing, and the qualifications which a lecturer ought to possess (pp. 70-79); these are well worthy the perusal of all who may be engaged in lecturing or science teaching; we find in them many of the precepts which Faraday followed through life, the observance of which made him the most lucid and elegant lecturer of our day. "A lecturer," he writes, "should endeavour, by all means, to obtain a facility of utterance, and the power of clothing his thoughts and ideas in language smooth and harmonious, and at the same time simple and easy. His periods should be round, not too long or unequal; they should be complete and expressive, conveying clearly the whole of the ideas intended to be conveyed. If they are long, or obscure, or incomplete, they give rise to a degree of labour in the minds of the hearers which quickly causes lassitude, indifference, and even disgust." . . . "A lecturer falls deeply beneath the dignity of his character when he descends so low as to angle for claps, and asks for commendation. Yet have I seen a lecturer even at this point. I have heard him causelessly condemn his own powers; I have heard him dwell for a length of time on the extreme care and niceness that the experiment he will make requires; I have heard him hope for indulgence when no indulgence was wanted; and I have even heard him declare that the experiment now made cannot fail, from its beauty, its correctness, and its application to gain the approbation of all."

During his travels on the Continent with Sir H. Davy, Faraday appears to have kept a careful journal; and this eighteen months of his life, although at times very distasteful, must have had a great effect on the formation of his mind and character, or rather in hastening or ripening his more prominent characteristics. It was, of course, a matter of much benefit to him (too often forgotten by those who speak of his self-education, without any of those advantages which the educated usually possess, &c.) to be in constant communication with one of the most brilliant and profound chemists in Europe, to work with him and for him, to notice the tone and manner of his thought, his treatment of questions of science, his mode of interrogating nature. It was advantageous to see other countries, study other languages, to examine scientifically, and with such a man as Davy, various natural phenomena and results of former phenomena not presented to us in these Islands. We find him one day working at the compounds of iodine (then recently discovered) in the laboratory of the Jardin des Plantes; on another, making the ascent of Vesuvius; he is now burning diamonds with Cosmo de Medici's great lens, now at a masked ball in a domino, or a spectator of the races in the Corso. During his tour, he appears to have had a good deal of time to himself, although, in certain respects, he did not find his post of amanuensis either a sinecure, or exactly what he expected as regards occupation.

Faraday returned to England in 1815, and now commenced his "early scientific training at the Royal Institution." He gave seven lectures during the year at the City Philosophical Society, on various subjects connected with chemistry, and he published his first paper ("An Analysis of Native Caustic Lime") in the *Quarterly Journal of Science*. In concluding his fifth lecture, he says:—"The philosopher should be a man willing to listen to every suggestion, but determined to judge for himself. He should not be biassed by appearances, have no favourite hypothesis, be of no school, and, in doctrine, have no master. He should not be a respecter of persons, but of things. Truth should be his primary object. If to these qualities be added industry, he may, indeed, hope to walk within the veil of the temple of Nature."

Five years later, Faraday, who was then in his twenty-ninth year, commenced what Dr. Bence Jones has well called his "higher scientific education at the Royal Institution." He had for seven years been the private assistant of Davy, and assistant in the laboratory and lecture-room. He had lectured with much success, both in the matter of speech and of experiment, and he had published thirty-seven notices and papers in the *Quarterly Journal of Science*. Yet, with all this, he did not publish the first

of his "Experimental Researches on Electricity" for eleven years from this date; and this period between the end of his first seven years of science-study and the commencement of the publication of these great researches was the time of his higher education in science. Faraday had for many years kept a common-place book. In 1822, he commenced a new and more detail note-book, which he called, "Chemical Notes, Hints, Suggestions, and Objects of Pursuit." In this, we find mention of many researches, which were elaborated and published at a later date. For instance:—

"General effects of compression, either in condensing gases or producing solutions, or even giving combinations at low temperatures. . . .

"State of electricity in the interior and on the surface of conductors, and on the surface of holes through them.

"Transparency of metals. Sun's light through gold-leaf. Two gold leaves made poles—light passed through one to the other."

At a later date, he wrote at the commencement of this collection of notes—"I already owe much to these notes, and think such a collection worth the making by every scientific man. I am sure none would think the trouble lost after a year's experience."

In 1823, Faraday was elected a Fellow of the Royal Society; and other scientific honours now began to be offered him. He received, altogether, ninety-five honorary titles; and of these he said:—"One title—namely, that of F.R.S.—was sought and paid for; all the rest were spontaneous offerings of kindness and goodwill from the bodies named."

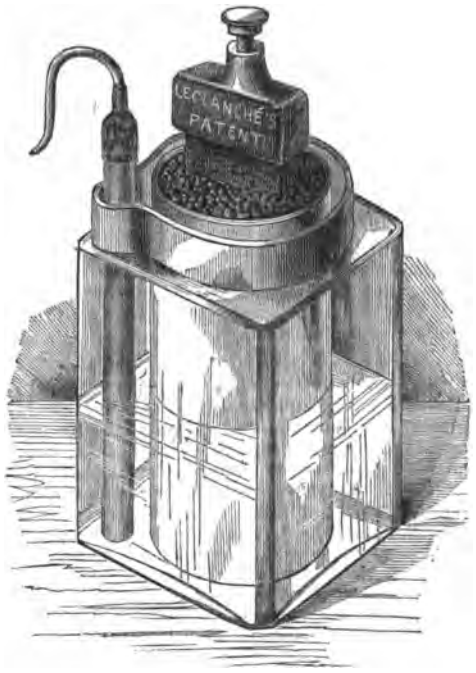
In 1825, on the recommendation of Sir H. Davy, Faraday was appointed Director of the Laboratory of the Royal Institution; and one of his first acts was to invite members of the Institution to attend evening meetings in the Laboratory, at which Faraday showed new and striking experiments. From these meetings sprang the Friday evening discourses so well known to all of us, and the establishment of which probably, remarks Dr. Bence Jones, "saved the Institution."

Let us, now that we have arrived at the last year (1839) of Faraday's higher scientific education, pass in review some of his work, before passing to the commencement of that great series of researches which numbered more than fifteen thousand paragraphs, and was concluded in 1856.

He had already made notable researches on electro-magnetic motions, on the condensation of gases, on the manufacture of glass for optic purposes, and on the alloys of steel. He had discovered two chlorides of carbon, benzol and sulpho-naphthalic acid; and he had made various experiments on the diffusion of gases. Moreover, he had published sixty scientific papers, nine of which were in the *Philosophical Transactions*. Here, then, for the present, we will leave him, in his thirty-ninth year.

Treatise on the Leclanché Battery: Preceded by a Few Remarks on the Employment of Electrical Batteries in Telegraphy. London: The India Rubber, Gutta-Percha, and Telegraph Works Co., Silvertown, Essex, and 100, Cannon Street, London.

IN this pamphlet will be found a full description of the Leclanché cell, the main feature of which is that peroxide of manganese is used with zinc (amalgamated) and an aqueous solution of an alkaline salt, chloride of ammonium being preferred. The author states, and his statement is borne out by comparative experiments made with the Marié-Davy, Daniell, and Bunsen cells, that the Leclanché cell is preferable to any other. The cells are of three sizes, and the shape is shown in the accompanying cut; the smallest, with a porous pot 4·3 inches high, can accomplish an annual electric work which may be represented by 620 grains of copper reduced in the voltameter; the medium size, with a 6-inch porous pot, can reduce from 950 to 1000 grains, while the large size gives a work equal to 1500 or 2000 grains. We have ourselves tried the cell, and can recommend its use to those



who require galvanic electricity for telegraphic or other purposes.

CORRESPONDENCE.

THE METEORIC IRON OF DEESA.

To the Editor of the Chemical News.

SIR,—I find in the CHEMICAL NEWS (vol. xx., p. 274) an abstract of the memoir published by *Cosmos* concerning the meteoric iron of Deesa.

Allow me to observe that the results indicated (except those which relate to the elementary composition of the metallic part) have not been obtained by M. Domeyko, but by myself.

I will add that the examination of the Deesa mass has led me to considerations which I believe to be new on the origin of meteorites.

The characters offered by this mass are such that it is impossible not to perceive in it a specimen of the first *meteoric eruptive rock* hitherto observed.

Consequently, the meteorite mass of Deesa permits us to affirm that meteorites, anciently in *statographical relations*, come from a globe, now broken up, which formerly revolved round the earth.

Finally, the consideration of *meteoric dykes* gives us the relative geological age of meteorites.

I shall be very glad if this letter can find a place in your most valuable journal.—I am, &c.,

STANISLAS MEUNIER,
Docteur ès Sciences,
Aide Naturaliste au Muséum.

23, Rue de Vaugirard, à Paris, Dec. 4th, 1869.

PHOSPHAMIDES.

To the Editor of the Chemical News.

SIR,—In your last number, among the "Chemical Notices from Foreign Sources," is an abstract of a paper by Schiff,

in Beilstein's *Zeitschrift für Chemie*. In that paper he comments on one of mine, and re-asserts the existence of phosphotriamide, $P(NH_2)_3O$; but it is evident that his acquaintance with my communications to the Chemical Society on the various phosphamides is imperfect, and a statement of the different results of our experimenting may not be without its value.

Schiff's statement is that ammonia gas, passed over oxychloride of phosphorus, is capable of eliminating the whole of the chlorine, producing a triamide, thus :—

$$PCl_3O+6NH_3=P(NH_2)_3O+3NH_4Cl;$$

and that this triamide may be separated from the chloride of ammonium by means of water, in which it is insoluble.

My statement is that I have never succeeded in replacing more than two equivalents of chlorine at any temperature, and that the amidated oxychloride thus produced is at once decomposed by water with the formation of pyrophospho-triamic acid, thus :—

$$PCl_3O+4NH_3=PCl(NH_2)_2O+2NH_4Cl, \text{ and}$$
$$2(PCl(NH_2)_2O)+2H_2O=P_2(NH_2)_3HO_4+NH_4Cl+HCl.$$

But, where a high temperature has been employed in saturating the oxychloride with ammonia, the product of the action of water is not the -triamic acid, but what I have called pyrophospho-pentazotic acid, $P_4N_5H_9O_7$.

Schiff's original view rested mainly on one determination of phosphorus and nitrogen in his supposed phosphotriamide, which, however, gave numbers not very accordant with theory, while the phosphorus is nearly the same under either view. In his present note, he rests rather on the fact that the white powder, when heated *per se*, gives off ammonia without any chloride of ammonium, leaving PNO, and losing 36 per cent in weight.

My view rests on a large number of analyses of the two acids and their salts, and on the fact that, in my experiments, the oxychloride of phosphorus could never be made to increase in weight by the absorption of ammonia more than about 44 per cent, while a complete replacement of the chlorine would give 66·3.

It is evident that, under either view, ammonia without any chlorine must be given off when the white substance is strongly heated, and that phosphonitryl, PNO, is a probable result. I have already stated that pyrophosphotriamic acid, heated at low redness, gives off about 10 per cent of ammonia; and in an experiment, made for the purpose of determining how great a loss the substance would suffer when strongly heated, 16·85 per cent was all that could be obtained, and the black fused mass that remained in the tube was not pure phosphonitryl.

That Schiff should obtain a loss of 36 per cent would seem to indicate that he has produced some different compound from any of the acid amides, the formation of which has been my invariable experience.—I am, &c.,

J. H. Gladstone.

17, Pembridge Square,
Dec. 9, 1869.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the Chemical News, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

Note. All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de l'Académie Impériale des Sciences de St. Petersbourg, Vol. xiv., No. 2, 1869.

The only paper relating to chemistry in this number is :—

Absorption of Hydrogenium by Iron Galvanically Obtained.—M. Jacobi.—Iron, precipitated galvanically, is described by the author as a silver-grey coloured, velvety-looking, very finely-grained mass, of 7·675 sp. gr. at 15°; this metal is so hard that it scratches glass, but is, also, very brittle. When this metal was very carefully ignited in a covered platinum crucible, its colour became deeper, its hardness and brittleness were lost, and its sp. gr. had increased to 7·811, which is higher than that of wrought-iron. The fact of this increase of specific gravity led the author to conclude that the iron might contain gas absorbed in its substance. A quantity of 9·730 grms. were treated in a Sprengel's aspirator, with the result that, aided by an increased temperature, which was carried to dull-red heat, 17·76 volumes of gas, chiefly composed of hydrogen, were obtained from the quantity of iron submitted to experiment.

Les Mondes, November 25, 1869.

This number contains the following original matter :—

Speech at the Opening Meeting of the German Naturalists and Physicists, at Inspriick.—Dr. Helmholtz.—From this very eloquent and very able speech, we quote the few following phrases :—The discovery of the common tie existing between and uniting together all the phenomena of nature, is the final aim of all science, and towards the reaching of that aim the efforts of all workers of science must be directed; only the knowledge of the laws which rule and govern the material world will enable man to make it obey his will. The speaker, in his discourse, referred briefly to astronomy, as the science of the laws of gravitation; to chemistry, as the science of inalterability of matter and its varied combinations; and next spoke about conservation of forces. At the conclusion, the speaker stated that Germany is, therefore, in advance of all the rest of the scientific world; because, out of that country, and more especially in France and England, scientific men had to heed social, and, far more yet, religious prejudices, and were thereby prevented free utterance of thought, since it would damage their social influence. On the whole, the speech is thoroughly Teutonic in the highest sense of the word, and the terseness, as well as the eloquence of the printed report, cannot fail to imbue the reader with respect for the very sound and able manner wherewith the eminent speaker discussed, extempore, abstruse scientific truths. Under the presidency of Prof. Hlasiwetz, of Vienna, the following papers were read in the chemical section :—(1) On "Iodoform," M. Lieben; (2) "On Lactic Acid," M. Wislicenus; (3) "On Phenylic Brown," M. Rolly; (4) "On Proteine Substances," M. Schwartzenbach; (5) "On the Sulphurets of Nitrogen," M. Claust; (6) "On the Hydruret of Palladium," M. Bœttger; (7) "On Anthracen," M. Petersen; (8) "On Hydrargyrodinaphthyl and Phenyl," M. Otto.

Presence of Salt in Sea Air.—Dr. Gillebert d'Hercourt.—From a series of observations made at Monaco, on the shores of the Mediterranean, the author concludes that there is always on the sea shores an atmosphere impregnated with saline particles; this layer of air has, at the above-named place, some 500 metres' horizontal, and some 60 metres' vertical extent. This impregnation of salt is due to what the author terms "pulverisation" of the sea-water by the breaking-up of the surf, and is not directly influenced either by barometric pressure, hygrometric state of the atmosphere, or its temperature. This hydro-mineral dust (*poussière*), as it is called by the author, is, unless there happen to exist near the coast physical obstacles, in the shape of high mountains, carried far away inland, and is not to be confounded with what is of more coarse nature, and termed "spray," which is only quite local, and produced when a gale of wind blows. The author states that, even on calm days in winter, the atmosphere near Monaco is at least up to a height of 70 metres, and some few miles inland impregnated with this hydro-mineral dust. There is no tide (rise or fall of water) perceptible in the sea alluded to.

Journal de Pharmacie et de Chimie, November, 1869.

This number contains the following original papers :—

Researches on the Bleaching of Tissues.—M. Kolb.—The second portion of a lengthy paper on this subject.

On Carlinate of Potassa and Carlinic Acid.—M. Lefranc.—Carlinate of potassa is a white-coloured salt, crystallising in needle-shaped crystals, and soluble in water and in alcohol of 60 per cent. When it is carefully heated, it fuses in its water of crystallisation; and when the heat is increased, it burns off, leaving carbonate of potassa. The aqueous solution of this salt gives no precipitate with chloride of barium, and with neutral or basic acetate of lead; with nitrate of silver it yields a white precipitate, insoluble in acetic, but soluble in nitric acid. The carlinic acid is separated from any concentrated aqueous solution of a carlinate, by means of a slight excess of tartaric acid. Alcohol is added in excess, the fluid filtered, and next evaporated upon a water-bath to dryness, and taken up with ether, from which the acid separates, on evaporation, in a crystalline shape. The acid is very soluble in water, alcohol, and ether, and is naturally met with in the roots of the *Carlina gummifera*, L.

Best Method of Preparation of Emetics.—M. Fleury.—This is a short memoir, not as would be inferred from its title, on the preparation of the potassio tartrate of antimony, but on the preparation of a series of double salts of tartaric acid and bismuth with lime, baryta, magnesia, protoxide of manganese, oxides of copper and zinc; of tartaric acid with chromium, lime, and baryta, and similar salts of iron. The author promises to give, in a future paper, the mode of preparation and analysis of all these salts.

On Chloral.—M. Poggiale.—The contents of this paper are superseded by the paper on this subject abstracted by us from the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin*, No. 16, 1869.

Camphor Water.—M. Jeannel.—The question of the solubility of camphor in water has been often discussed. According to the author, an alcoholic solution of camphor was made containing 0·375 grm. per c.c.; and a litre of water at 15° does not dissolve more than 0·75 grm. of camphor from this solution after twenty-four hours' contact and frequent shaking. The author states that alcohol does not increase perceptibly the solubility of camphor in water; alcohol at 20° only dissolves 2·437 grms. of camphor, and at 35°, 6 grms. of that substance per litre of alcohol.

Explosion Caused by the Incautious Making-Up of a Medicinal Prescription.—M. Vigla.—The following prescription was handed to a pharmaceutist:—Chlorate of potassa, 8; hypophosphite of soda, 4; simple syrup, 62; water, 125. The operator put the dry salts in a mortar, and commenced rubbing them vigorously, when a most violent explosion ensued, whereby the mortar was smashed to atoms and the operator seriously wounded. The proper course would have been to dissolve each of the salts separately in water.

Moniteur Scientifique, December 1, 1869.

This number contains the following original papers:—

The Physical Phenomena Manifested by Living Organised Beings.—M. Gavarret.—In a lengthy paper, the author discusses and explains the physico-chemical phenomena of life, as far as this is possible. The paper is recommended to the attention of all who study biology.

Artificial Alizarine made by MM. Meister, Lucius, and Co., at Hoechst.—M. Kopp.—Since this subject is, in a scientific as well as industrial point of view, of great importance, we abstract this paper, notwithstanding the same subject has been lately treated by Dr. Bolley. M. Kopp received, from the well-known chemist, M. C. Kœchlin, a quantity of 250 grms. of this artificial alizarine, in the shape of a paste, containing only 7 per cent of dry substance, ash inclusive. The author states that this substance produces a most brilliant and very fast Turkey red. The artificial alizarine was dissolved in a weak aqueous solution of carbonate of soda, filtered and precipitated by means of pure HCl, and the precipitate collected on a filter until the filtrate was quite neutral; the material, thus purified, was used for the purpose of comparison with pure alizarine as obtained from madder. Equal quantities of each of these two substances were dissolved in a weak solution of caustic soda, and with these solutions the following tests were made:—Artificial alizarine $+Na_2O+Cl_2Ba$: violet-blue precipitate, supernatant liquid somewhat faintly rose-coloured; natural alizarine, and the same reagents; also a violet-blue precipitate, supernatant liquid faintly yellowish-rose coloured. Artificial alizarine $+Na_2O+ClCa$: a violet precipitate, supernatant liquid wine-red coloured; natural alizarine, and ditto reagents, ditto precipitate, supernatant liquid wine-red coloured, but less deeply. Other reactions were instituted, all leading to the manifest conclusion that there is no essential difference between this artificial alizarine and natural alizarine. The author records, at length, his experiments with this artificial alizarine, and the action of nitric acid upon this substance, the result of which is that the substance in question gives rise, not only to the formation of phthalic acid, but also nitro-picric acid. When this dried artificial alizarine is treated, at between 150° and 170°, with boiling petroleum oil, a large proportion of the colouring matter is dissolved, and, on cooling, deposited from the oil in needle-shaped crystals. Dr. Quesneville, the editor of the periodical above quoted, adds to M. Kopp's paper a letter received by him, the main purport of which is that MM. Græbe and Liebermann, at Berlin, have been having, with the firm of Meister, Lucius, and Co., a lengthy correspondence, and have been treating with them for the carrying out of their invention on the large scale. These negotiations do not appear to have been successful; and the head of the firm at Manheim, which now carries on the working of the patent of MM. Græbe and Liebermann, happening to be at Berlin while the negotiations with the firm at Hoechst were still pending, accepted the terms made by MM. Græbe and Liebermann; and there is reason to suppose—and this supposition is strongly confirmed by the researches made by MM. Kœchlin, Bolley, Alfraise, and Kopp, on the artificial alizarine made at Hoechst—that that substance is, in reality, obtained by the process discovered by MM. Græbe and Liebermann, and not, as it is made to appear, by a peculiar process the invention of the manufacturers.

On Ipecacuanha and Emetine.—M. Lefort.

Use of Alkaline Sulphurets for the Purpose of Bleaching Fibres and Tissues of Vegetable Origin.—M. Tessié du Motay.—The chief point in this paper is that the author supposes that the alternate action of reducing and oxidising substances accelerates the bleaching of hemp, flax, and cotton, and the tissues made thereof, and that the strength of the fibre is less impaired by this process. The substances applied as reducing materials are the sulphides of barium or calcium mixed with some sulphide of sodium, and the oxidising substance is chlorine water.

Revue Hebdomadaire de Chimie, November 25, 1869.

New Kind of [illegible] Gas Furnace.—MM. Bergé and Delheid.—This [illegible]-lamp, is a modification of the Bunsen burners furnace, or, better, blas[illegible]om the latter in the following particulars:—in general use, and differs fr[illegible]on of the air, which is made to come in (1) By the mode of the admissi[illegible] level therewith, or above it, as in below the gas, and not on the same [illegible] admission of a larger quan the ordinary Bunsen burners; (2) by th[illegible]ire area of the tube; (3) by tity of air, by making it pass through the en[illegible]vent the heating of the the addition of an outer cylinder, placed to pre[illegible] tube from which the flame issues, by making a current of air pass between the two. From the report of the makers of this apparatus, it appears to be of immense service, especially for fusions of mineral substances requiring a high temperature and long-continued heat.

Mode of Treatment of the Fermented Molasses' Juice in order to Extract therefrom Crude Potassa Salts.—MM. Crespel and Bocquet.—The authors add, to the residue of the distillation of the previously-fermented molasses as obtained from beet-root sugar making, a sufficient quantity of carbonate of baryta to convert the sulphuric acid present therein as sulphates into carbonates, and thus to obtain more carbonate of potassa in the saline residue after calcination. The sulphate of baryta formed hereby is re-converted into carbonate by well-known methods.

Formation of Ellagic Acid by means of Gallic Acid.—M. Lowe.—When an aqueous solution of two equivalents of gallic acid and one equivalent of arsenious acid is boiled for several hours, a crystalline precipitate is formed, which is ellagic acid. When it is desired to prepare the latter in quantity, the mixture of the two substances alluded to is made in the proportions mentioned, and, after having been boiled and evaporated to dryness at 120°, is exhausted with alcohol at 90 per cent, wherein the ellagic acid only is soluble.

December 2, 1869.

Salts of Uranium and Cobalt.—M. Selborst states that, notwithstanding some assertions made to the contrary, the solutions of salts of uranium and cobalt are not fluorescent in Geissler's tubes.

Chemical Method of Purifying Tissues made of Animal Fibres.—MM. Bang and Monestier.—The authors state that woollen and silken tissues are purified from vegetable fibres accidentally mixed up therewith, by steeping the tissues in a mixture of equal parts of water and strong sulphuric acid at 90° temperature, followed immediately by a very efficient washing in plenty of cold water, best a running stream.

Bleaching Wool and Silk.—M. Frézon.—The author proposes to substitute, for the ordinary sulphuring, as it is termed, the use of a mixture of equal parts, by weight, of oxalic acid and common salt, of each 2 kilos., upon 1000 litres of water. The tissues, or yarn, to be bleached is left in this bath for one hour, and next washed in plenty of fresh water.

Boiling-Point of some Concentrated Solutions of Salts.—M. Legrand.—Upon 100 parts of water, each of the following substances, in the quantities quoted, yields a solution, the boiling-point of which is expressed in °C.:—61·5 of chlorate of potassa, 104·2°; 60·1 of chloride of barium, 104·4°; 48·5 of carbonate of soda, 104·63°; 112·6 of phosphate of soda, 106·6°; 59·4 of chloride of potassium, 108·3°; 41·2 of chloride of sodium, 108·4°; 88·9 of chloride of ammonium, 114·2°; 296·2 of neutral tartrate of potassa, 114·67°; 335·1 of nitrate of potassa, 115·9°; 117·5 of chloride of strontium, 117·85°; 224·8 of nitrate of soda, 121·0°; 209·0 of acetate of soda, 124·37°; 205·0 of carbonate of potassa, 135°; 362·2 of nitrate of lime, 151°; 798·2 of acetate of potassa, 169°; 325 of chloride of calcium, 179·5°; an unlimited quantity of nitrate of ammonia, 180°. All the salts to be applied in dry state.

The Journal of the Franklin Institute, October, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Various Processes for Preserving Timber.—Dr. Ott.—From this paper, the second portion of a lengthy memoir on this subject, we learn that the opinion that carbolic acid, and substances containing it, or supposed to contain it, are effectual in preserving timber, is erroneous. The real preservative action of the tar-oils are due, according to this author, to a greenish fluorescent oil that comes over at the last stage of the distillation. Direct trials with pyren and paranaphthaline do not yield successful results. The question whether tar (coal-tar) does contain a sufficient quantity of the fluorescent greenish oil just alluded to, so as to justify the use of coal-tar for preservative purposes, is answered in the negative. The decay of timber, or peculiar transformation which makes it unfit for practical purposes, seems to be, in most instances, produced by the attack of fungi and lichens. The mouldering of wood is distinct from decay, it being merely a chemical process caused by the action of water with small access of air. None of the processes invented to preserve timber by chemicals are perfect; the most simple and practical method is the old, but, unfortunately, far too slow, plan of properly subjecting timber to the action of air and water, as practised in ship-building yards.

This number is almost entirely filled with various valuable papers on the late solar eclipse.

American Journal of Pharmacy, November, 1869.

This number contains the following matter more particularly relating to chemistry:—

Prevention of the Bumping of Liquids.—M. Schumann.—After briefly referring to the several suggestions made for this purpose, and, among these, in particular to Dr. H. Müller's process, the author says—In distilling acids and other liquids, I proceed in the following manner:—The end of an ordinary glass pipe, of about ¼ of an inch opening, is shut at one end, and this end bent into a little hook; the glass pipe is then cut exactly so long as to reach from the bottom of a glass retort to within ¼ or 1 inch of the stopper of the tubulus. By

means of the hook and a piece of twine, or a little hook of thin wire, this glass pipe is placed into the retort, the open end at the bottom, and the retort can be filled, or the retort is filled first and the glass pipe entered afterwards. If the liquid is warmed, the air in the glass tube is expanded, and constantly bubbles out at the open end; and if the boiling-point is reached, vapours of the tension of the atmosphere are formed at the spot where the glass pipe stands on the bottom of the retort, and the boiling continues regularly and quietly.

New Properties and Uses of Naphthaline.—Dr. Ott.—After relating the manufacture of this substance, the author says—Pure naphthaline, as now met in the trade, is similar to alabaster, cracks easily in the warm hands, and becomes negatively electric on being rubbed with silk. Its sp. gr. at 66° F. is 1·15173, melts at 174° F., and boils at 452° F. Molten naphthaline absorbs a large quantity of air, which is given off again on cooling; according to M. Vohl, this gas is pure oxygen. Molten naphthaline dissolves indigo with great facility, forming a dark blue violet liquid, from which the indigo separates on cooling, forming fine shining needles like copper. The amorphous sulphides of arsenic, tin, and antimony are also readily dissolved, and likewise phosphorus, sulphur, iodine, the iodide and chloride of mercury, arsenious, succinic, benzoic, and oxalic acids. Naphthaline can be converted into naphthalic, or phthalic acid, and this latter into benzoic acid, and that, in its turn, into benzol. Naphthaline, $C_{20}H_8$; phthalic acid, $C_{16}H_4O_8$; benzoic acid, $C_{14}H_8O_2$; benzol, $C_{12}H_6$. For the conversion of naphthaline into phthalic acid, 12 parts of pure naphthaline are dissolved in 90 parts of concentrated sulphuric acid, and, next, 80 parts of best finely-powdered peroxide of manganese are added. After the reaction is complete, the product is boiled in five times its own bulk of water, until no more carbonic acid gas is given off; the fluid is next diluted with water, filtered, and evaporated. The conversion of the phthalic acid into benzoate of lime, at a temperature of from 625° to 660 F., is performed in vacuum, but requires considerable skill and practice; an excess of lime is required.

NOTES AND QUERIES.

Testing Lemon-Juice.—"A. S." is referred to O'Neill's "Chemistry of Calico Printing and Dyeing, &c.," page 140 and following pages.

Glue and Gelatine.—(Reply to "G. G.")—See "Knapp's Technology," English edition, by Dr. Richardson and Mr. Watts; see Wagner's "Hand und Lehrbuch der Technologie," vol. v., p. 80 and following pages.

Mellite or Honeystone is a rather rare mineral, consisting of mellitic acid, alumina, and water; its colour is honey-yellow; it occurs in brown coal in Thuringia, near Bilin, Bohemia, and in a few other localities.

Utilisation of Sulphat e of Lime.—(Reply to "Glauber.")—Sulphate of lime, whether it be precipitated, or the native sulphate ground into powder, is useful as a manure by itself. If the article you allude to is very white and pure, it may find a sale among paper makers.

Bronze for Leather.—(Reply to "A Constant Reader.")—It would be impossible to give you the composition of such a substance as you allude to without actually testing the material; but it is very likely that the substance used is a strong alcoholic solution of aniline purple, which is applied for bronzing purposes.

Acacia Charcoal.—(Reply to R. Trevor Clarke.)—This is probably inferior to willow charcoal; the latter makes a very soft smooth powder, and mixes readily with water. The wholesale price varies from 1s. 4d. to 1s. 6d. per lb. Logwood charcoal has been sold under the name of "the immortal carbon."—G. A. K.

Acacia Charcoal.—(Reply to R. Trevor Clarke.)—You are quite correct as to your surmise concerning acacia charcoal; refer to Pereira's "Materia Medica," 4th edition, vol. i., page 320 and following. Wood charcoal obtained from the lime, or linden tree, *Tilia Europea*, L., is officinal in some Pharmacopœias. The cause you suggest of the failure of the use of flowers of sulphur is, we think, wrong; the reason is that, unless flowers of sulphur have been washed, they always contain sulphuric acid. Roll sulphur only is used in the powder manufacture for the same reasbn.

Analysis of Nitrous Oxide.—Happening to meet with a copy of Roscoe's "Elementary Chemistry," and looking over the article "Nitrous Oxide," I find he asserts that, after analysis of the gas by potassium in a bent tube over mercury, the products, after combustion of the metal in the gas, are nitrogen and potassium hydroxide, KHO! Where does the H come out of? will Professor Roscoe kindly explain this?—VERITAS, Liverpool.

Specific Gravity.—Would you kindly favour me with an answer to the following question:—I read of solutions as being of sp. gr. 1·053, &c. Now what is the rule for determining these strengths by Twaddle's hydrometer; or, in other words, how may I know the rule for calculating these strengths, that when I see the sp. gr. I may calculate them, so as to be able to know at what number of degrees is equal on Twaddle's? I should be glad if you would enlighten me on this point. —CHAS. H. PARKIN.

Electro-Deposition of Copper upon Cast-Iron.—In attempting the above, the writer finds great difficulty in obtaining adhesion between the copper and the rough surface of the cast-iron, previously cleansed by dilute sulphuric acid. Whether the deposit be made slowly or quickly, it is soon separated from the iron by a black powder, which appears to consist chiefly of carbon, silica, &c. Information, or reference to treatises, will be much esteemed by HISTRIX.

Treatment of Oils for Machinery Purposes.—Can any of your readers supply any information upon the process of refining animal and vegetable oils, having special regard to the abstracting the gummy or albuminous matter, without introducing any acids that would be injurious to the machinery afterwards; or perhaps they could recommend some work which treats upon the subject.—B. S.

Gas and Oil Furnaces.—"J. C.," who enquires about gas and oil furnaces, in the CHEMICAL NEWS of September 24th and December 3rd, will find the coke produced in distilling crude anthracene and coal-tar grease from asphaltum to yield him the intense heat he requires, practically free from sulphur and deposit. It could be used in the Siemens regenerative furnace or otherwise.—WM. SCHOFIELD.

MEETINGS FOR THE WEEK.

MONDAY, Dec. 20th.—Medical, 8.

—— Society of Arts, 8. J. Norman Lockyer, F.R.S., "The Spectroscope and its Applications."

—— London Institution, 4. Prof. Guthrie, "Elementary Physics."

WEDNESDAY, 22nd.—Society of Arts, 8. Dr. J. L. W. Thudicum, "On Wines—Their Origin, Nature, Analysis, and Uses; with Special Reference to a New Alcoholic Drink Made from Tea."

—— Geological, 8. 1. Ralph Tate, F.G.S., and J. S. Holden, M.D., F.G.S., "On the Iron-Ores Associated with the Basalts of the North-East of Ireland."
2. J. W. Hulke, F.R.S., "Note on the Skull of the Large Kimmeridge Crocodilian, *Dakosaurus maximus*, Quenstedt, *Steneosaurus*, Geoffr. St. Hilaire."
3. J. W. Hulke, F.R.S. "Note on a Fragment of a Jaw with Peculiar Teeth, from Kimmeridge Bay."
4. Principal Dawson, F.R.S., of Montreal. "Notes on the Structure of *Sigillaria*."
5. Principal Dawson, F.R.S. "Notes on some New Animal Remains from the Carboniferous and Devonian of Canada."

TO CORRESPONDENTS.

CORRIGENDUM.—In Mr. Tomlinson's paper, page 278, column 2, line 27 from bottom, *for* "a small portion of a salt, soluble in water," *read* "a small portion of a salt, *such as soda*, soluble in water."

Analyst.—Chevreul's work, "On Fats," is very rare; it was published about the year 1828.

Alfred Bird.—Received, with thanks.

A Three Years' Subscriber.—You cannot make an extra strong boiled oil; but the older the oil before it is boiled the better for your purpose.

D. F.—A book treating, among other subjects, on Bleaching of Linen, by the Editor of this paper, is in the press, and will shortly be issued.

BOOKS RECEIVED.

A Manual of Diet for the Invalid and Dyspeptic, with a Few Hints on Nursing. By Duncan Turner. London: Churchill.

A Treatise on Asiatic Cholera. By C. Macnamara. London: Churchill.

Professor Tennant, F.G.S., will deliver a Course of Lectures on MINERALOGY applied to GEOLOGY and the ARTS, at King's College, London, on Wednesday and Friday mornings, at nine o'clock, during October, November, and December, commencing October 8th. Fee, £2 2s.

A Course of Lectures on MINERALOGY and GEOLOGY will also be delivered, on Thursday evenings, at eight o'clock. These begin October 14th, and will be continued to Easter, 1870. Fee, £1 11s. 6d. Professor Tennant gives PRIVATE INSTRUCTION in Mineralogy and Geology, Illustrated by a large number of Specimens, at his Residence, 149, Strand, W.C.

The Mysteries of Udolpho.—Astounding Effects!! Innumerable Ghosts appear and disappear!! Three emanate from One!! The Scenes by Fid. Bell. the Dungeon. — Occasionally, AMSTERDAM ... ettles crawl BITION, visited by Professor Pepper.—PEC... ...d its EXHI. OF THE PERIOD, By Messrs. Ward ... ULIAR PEOPLE RELICS of the late MAXIMILIAN.—... ...oper.—ACCREDITED NDUCTORIUM is being increased ... the GREAT LIGHTNING and science.—THE MYSTER... ... in power; the wonder of the age introducing Herr Angyal... ...OUS HAND.—PETIT CONCERT, the Misses Campbell. ..., the justly renowned Basso Profundo, —ROYAL POLY... ...and Herr Schalkenbach on the Electric Organ ... POLYTECHNIC.—One Shilling.

THE CHEMICAL NEWS.

VOL. XX. No. 526.

ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 293.)

IN the modes of illumination hitherto described, the light has been made use of in exactly the same condition in which it was received from its source, whether from the sun or a lamp. All that instruments have been required to do has been either to alter its direction or, by concentration, to increase its intensity. It is now proposed to explain a method of conducting microscopical investigations in which the properties of the light have undergone such changes as to produce effects totally different from those of ordinary illumination, and with the result of giving greater insight into the nature of certain structures than could be obtained by other means. The light, in the condition now to be described, is commonly known as *Polarised light*.

With a view to simplify the matter contained in the foregoing papers, no more has been said about the nature and properties of light than was absolutely necessary to enable the action of the apparatus described from time to time to be tolerably well understood. And, although, in the present chapter, far more notice must be taken of the subject, it is by no means intended to give an exhaustive account of the phenomena of polarised light. Space can only be afforded for such an outline as will enable the student to use his apparatus, and observe intelligently. For details, reference must be made to works treating more fully on the subject—such as the chapters on Optics in Mr. Brooke's "Manual of Natural Philosophy," and the various authorities there referred to.

Light, in common with the other forces of nature—heat, electricity in its various forms, dynamic force, &c.,—proceeds from its source in a series of undulations or waves, which may be illustrated in a rough manner by throwing a stone into a pond, when the waves will be seen to spread themselves concentrically from the source of motion.

For convenience of explanation, a ray of light in its ordinary condition may be represented in ideal section by a circle (Fig. 33, 1), and undulations supposed to take place in two planes at right angles to each other (C, D and N, S). By means presently to be described, these two sets of waves can be separated, as at 2, C, D and 3, N, S. The ray of light, instead of having the same properties on every side, will be found to have acquired some qualities peculiar to the state in which it now is, and which may be named the properties of sides. For instance, 2 will exhibit certain phenomena in the direction C, D which do not exist when it is examined in other directions. The same is the case with the other half of the ray (3), which exhibits similar phenomena in the direction N, S. As these properties somewhat resembled those of the poles of a magnet, the term *polarised light* was used to distinguish light so modified, and, although perhaps not the best name that could have been given, has still been retained.

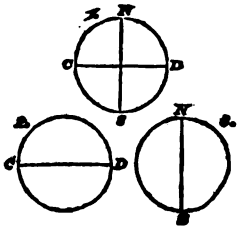
As the phenomena of interference will be frequently mentioned, it will be desirable to state what they are. The sensation affecting the optic nerve which is known as light is caused by the undulations before spoken of—light being represented by motion, darkness by rest.

Should two waves start together from the same place, they would increase each other's intensity; the result would be a wave of double height—a matter easy of comprehension, if water be considered as the medium; with the waves of air producing sound, the result would be a louder sound; and, with light, an illumination of double intensity. Should, however, one wave start before the other by the length of half a wave, the effect would be that the crest of one wave would occupy the position of the hollow of the other, and so fill it up, producing a dead level. The result would be, with water, calm; with air, silence; with light, darkness.

This is known to be the case, in some instances, where the streams from two channels meet in the manner just mentioned: perfectly smooth water is produced, although, before meeting, the surface of both may be violently agitated.

Should the waves of light start at an interval of less than half a wave, they will, by interference, be

FIG. 33*.



broken up into smaller waves, the magnitude of which depends upon the distance one wave has had the start of the other. These small waves produce coloured light, the red wave being the longest, and the violet the shortest. Mr. Woodward gives the following as the lengths of the waves of the various coloured rays of the spectrum:—Red, 266; orange, 240; yellow, 227; green, 211; blue, 196; indigo, 185; violet, 167. The figures represent the numerators of fractions, having as a common denominator the ten-millionth of an inch.

These coloured waves may be produced in various ways; for instance, by very thin plates of transparent substances, such as mica, films of oil or varnish floating on water, and films of air enclosed between transparent solid surfaces, which, by causing a slight difference in the distance of the starting points of the two series of waves of white light reflected from the upper and lower surfaces of the film, sets up interference, and breaks up the waves of white light into smaller coloured ones. The films of varnish were very ingeniously taken up from the surface of water on enamelled cards, by Mr. De la Rue, giving them a beautiful iridescent appearance. Other examples may be found in the feathers of certain birds, as humming birds, peacocks, &c., which possess a metallic lustre produced in the same manner. A minutely grooved surface will also

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

* Brooke's "Natural Philosophy," published by Churchill.

produce similar effects; for example, mother-of-pearl, which consists of a series of thin plates of shell, separated by folds of membrane, producing a grooved structure; also in the finely-ruled gold ornaments known as "Barton's buttons," and the minute specimens of ruling on glass by Nobert, all of which produce brilliant metallic tints by the interference of the two waves reflected, one from the surface, and the other from the bottom of the groove.

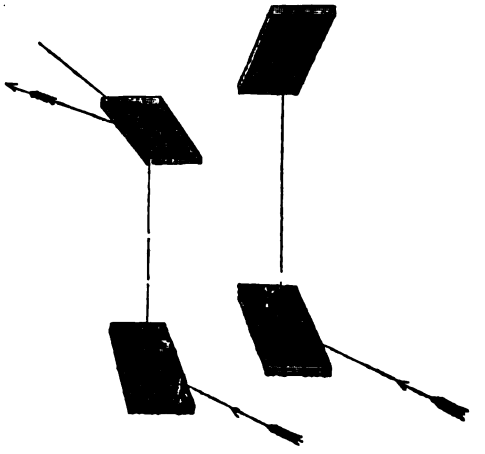
If a convex lens of extremely shallow curvature be placed upon a plane glass surface, and an arrangement be provided for exercising delicate and uniform compression, a series of circular concentric coloured bands will be seen; these are known as "Newton's rings," and are caused, as before, by the interference of the reflections from the film of air contained between the lenses; and as, from the curvature of the lens, the film is of a thickness increasing from the centre to the circumference, a variety of tints are formed at every change of thickness, the rings consisting alternately of groups of colour and dark bands, the latter being the places where total interference takes place, and darkness or rest is the consequence. These dark spaces are much better seen when the apparatus is viewed by a monochromatic light, such as that produced by the flame of a large spirit-lamp the wick of which has been sprinkled with common table-salt. Not only will the dark bands be sharper and more intense, but they will also be considerably increased in number. These rings may often be seen when plane glass surfaces are unequally compressed; for example, a piece of thin cover-glass pressed on a slide with a stick, and sometimes between the thick plate and glass negative in a photographic printing frame.

The undulatory motion of light would seem to be expressed with considerable clearness in the first chapter of Genesis when read in the original Hebrew, which, in common with the other languages of the same family, is remarkable for the numerous inflexions of its verb, which gives it a delicacy and precision of expression unattainable in Western languages. The first verse concludes:—"And the Spirit of God *moved* upon the face of the waters." This sentence immediately precedes the command that light, which may here be taken in its largest sense, including electricity and the other forces, should exist. The Hebrew word translated "moved" is more accurately expressed by *fluttered*; the same inflexion of the verb is used in this sense in the only other place in which it occurs, viz., Deuteronomy xxxii., 11., where it refers to the fluttering of an eagle over its nest. It is certainly a very remarkable expression, and the author believes that its bearing on the subject of light has hitherto escaped notice. The view that the word "light" includes the other forces, and which we have every reason to believe are but different manifestations of them, is supported by the fact, that sources of light proper or luminaries are not mentioned until the fourteenth verse, while the atmosphere or "firmament" of the English version, land, and water, and vegetable life, were all in existence, and under the influence of these mysterious powers of nature, respecting which the undiscovered and unknown probably far exceeds the little that science has at present made us acquainted with.

Light may be polarised in several ways. If a ray of light falls upon glass at an angle of 56° 45', one-half (Fig. 34) will be transmitted, the other half reflected; and, if, instead of a single plate, about ten sheets of thin window-glass be employed, the result will be much more perfect. The reflection, whether one or more plates be used, will be much improved by either coating the back with black-varnish, or placing in contact with it a piece of black cloth or velvet, which will absorb the transmitted portion of the ray. If the light so reflected be examined by another glass mirror, placed at the same angle, and so mounted that it can be moved horizontally in a circular direction, it will be found that, in some positions, the light will be reflected, while, at others, it will pass through, or be absorbed if the back is blackened. These intervals of reflection and transmission occur alternately at every quarter revolution of the upper mirror or analyser, corresponding with the points in Fig. 33, I, marked C, D and N, S.

If a ray of light be passed through a crystal of Iceland spar, one portion will be refracted according

Fig. 34.



to the usual law;* the other half will be refracted in a different direction. And, if these two rays of light be examined with an analyser, they will be found, as in the case of the reflected light, to have acquired the property of sides, or to be polarised. The ray refracted in the common way is known as the ordinary ray. The other, which is polarised in a plane at right angles to it, is termed the extraordinary ray. If a crystal of Iceland spar be placed on a sheet of paper having a black spot on it, the double refraction will cause the formation of two images of the spot or other device drawn on the paper.

(To be continued.)

ON THE ESTIMATION OF PEROXIDE OF MANGANESE IN MANGANESE ORES.

By E. SHERER and G. RUMPF.

The method of Fresenius and Will for the estimation of manganese, to which for so long preference has been given, has recently been objected to in England by the consumers of the ore. Attention has been called to the fact that this method shows, indeed, correctly the proportion of binoxide of manganese in the sample, but, on the other hand, does not represent its value as an agent for the production of chlorine.

* Chemical News, vol. xx., p. 145.

The reason for this is that metallic iron or its protocompounds, which are often present in the ore, absorb oxygen to form a sesqui salt when the sample is treated with hydrochloric acid, but remain unchanged when it is treated with concentrated sulphuric acid and oxalate of soda.

In consequence of this, the method of Fresenius and Will is still used in some laboratories, while, in others, it has been superseded by the iron method; from which circumstance an uncertainty in the valuation of the article arises, disagreeable alike to purchasers and sellers.

This has led us to subject the various methods to a careful examination and comparison one with another. Our object was to ascertain, by a series of experiments, how far the estimations by the same method agreed one with another, and then to discover the causes of the differences that have been observed between the results obtained by the different methods.

A sample of American manganese was used for our experiments. A large quantity was pounded, well mixed, and carefully dried at 100° C. The moisture amounted to 0·749 per cent. Quantities of the dry manganese were then at once weighed off for the various tests.

I. *According to the Method of Fresenius and Will.*

Years of experience having proved to us the constancy of results obtained by this method, we considered that three trials would be sufficient. These served to show the actual amount of binoxide in the sample.

1. 2·1098 grms. manganese caused the evolution of 1·355 grms. carbonic acid = 63·49 per cent.
2. 1·5103 grms. manganese caused the evolution of 0·970 grms. carbonic acid = 63·49 per cent.
3. 1·3645 grms. manganese caused the evolution of 0·8770 grms. carbonic acid = 63·53 per cent.

II. *According to the Iron Method.*

The estimations by this process were conducted in the following manner:—

A weighed quantity of pianoforte-wire was dissolved in hydrochloric acid, in a glass flask. Carbonic acid was conducted into the flask during the operation, to prevent the oxidation of the protochloride of iron produced by oxygen from the atmosphere. When complete solution had taken place, a small tube, containing an accurately-weighed quantity of the manganese, was dropped into the flask, the mixture boiled until complete decomposition had taken place, and then cooled in the stream of carbonic acid. The excess of the protochloride was then estimated in the usual way, by means of a standard solution of bichromate of potash. The weight of the iron wire, multiplied by 0·997, was taken as the amount of pure iron used.

1.	0·8748 grms. manganese 1·0796 „ pure iron	}	Chromate of potash used 22·7 c.c. = 62·00 per cent.
2.	0·7504 „ manganese 1·03668 „ pure iron	}	Chromate of potash used, 25·85 c.c. = 62·35 per cent.
3.	0·8746 „ manganese 1·1686 „ pure iron	}	Chromate of potash used, 27·65 c.c. = 62·54 per cent.
4.	0·7604 „ manganese 0·9692 „ pure iron	}	Chromate of potash used, 21·45 c.c. = 62·20 per cent.
5.	0·9312 „ manganese 1·3846 „ pure iron	}	Chromate of potash used, 38·2 c.c. = 61·97 per cent.
6.	0·5467 „ manganese 1·2183 „ pure iron	}	Chromate of potash used, 46·8 c.c. = 61·39 per cent.
7.	1·135 „ manganese 1·0787 „ pure iron	}	Chromate of potash used, 10·2 c.c. = 62·07 per cent.
8.	1·0446 „ manganese 1·0792 „ pure iron	}	Chromate of potash used, 14·6 c.c. = 62·01 per cent.

We therefore conclude, from these figures, that this method, proceeded with in the way we have described, does not yield accurate results.

III. *The Estimation of Manganese by the Formation of Chloride of Lime.*

The advantage that this method would seem to have over all others is that the manganese is treated in precisely the same manner in the laboratory as it is on the large scale in the manufacture of bleaching-powder.

Weighed quantities of the sample were treated with strong hydrochloric acid in a small flask until complete decomposition had taken place. The chlorine produced was conducted first into another flask, and then into a U-tube, both of which were filled with a weak milk of lime. The resulting chloride of lime was then tested by Gay Lussac's method, with arsenious acid.

		AsO_3. c.c.		per cent.
(1).	1·0561 grms. manganese	53·90	=	62·60
(2).	1·0845 „ „	56·05	=	63·39
(3).	1·2045 „ „	61·70	=	62·83
(4).	0·4222 „ „	20·70	=	60·14
(5).	0·8102 „ „	39·75	=	60·18
(6).	0·4929 „ „	23·15	=	59·06
(7).	0·4875 „ „	23·15	=	58·15

These figures sufficiently prove that no accurate results are to be obtained by this method.

We next experimented on Bunsen's method.

Weighed quantities of manganese were dissolved in hydrochloric acid in the same manner as in the preceding. The escaping chlorine was received in a strong solution of iodide of potassium, and the liberated iodine subsequently estimated by means of a standard solution of hyposulphite of soda and a solution of starch. To prevent the solution of iodide of potassium from being sucked back into the generating-flask, a few small pieces of magnesite were introduced with the manganese, so that a continual slight escape of carbonic acid took place through the solution.

The solution of hyposulphite of soda was proved by means of a carefully-prepared pure iodine. 3·0436 grms. were dissolved in iodide of potassium, and diluted to 250 c.c. 10 c.c. of this solution required 17·90 c.c. of the hyposulphite of soda solution. 1000 c.c. of hyposulphite of soda solution would, therefore, correspond to 2·3294 grms. of binoxide of manganese. A second trial, in which 2·4767 grms. of the pure iodine were used, 1000 c.c. of the hyposulphite were found to correspond to 2·3319 grs. of binoxide of manganese, which two results closely agree. In testing the manganese—

		NaO,S_2O_2. c.c.		per cent.
(1).	0·6472 grs. manganese	35·8	=	62·76
(2).	0·6427 „ „	34·6	=	62·73
(3).	0·6035 „ „	32·5	=	62·73

These results agreed so closely that we considered further estimations by this method to be quite unnecessary.

If we now compare the various results, we see that the sample, according to the method of—

	Average.	Greatest difference.
	per cent.	per cent.
Fresenius and Will showed	63·50 ..	0·04
Iron method showed	62·06 ..	1·15
Chloride of lime estimation showed	60·90 ..	5·24
Bunsen's method showed	62·74 ..	0·03

From this, we see that only the methods of Fresenius and Will, and that of Bunsen, give constant results; and, of these two, the latter-named undoubtedly represented the value of the ore as an agent for the production of chlorine, since only the chlorine evolved from the sample in the form of gas is estimated. We therefore may conclude that the method of Fresenius and Will gives results too high, while the iron and chloride of lime methods give results much too low. Our next step was to discover the reason for these differences. The cause of the high result obtained by the method of Fresenius and Will has

already been mentioned at the commencent of this paper. We did not consider it necessary to examine whether or no the sample on which we were operating actually contained iron or its proto-compounds. The object we had in view was a purely practical one; and the possibility of the presence of such iron compounds in the ore cannot be disputed. The following experiment proves that a very considerable addition of metallic iron will not in the slighest degree affect the accuracy of the results obtained by this method. 1·4706 grms. of metallic iron were added to 2·4745 grms. of the manganese, concentrated sulphuric acid added, and the test proceeded with as usual. The result obtained—viz., 63·13 per cent—differed only by 0·37 per cent from the average of the three previous trials made by this method, notwithstanding that the amount of iron added was sufficient to render three-quarters of the manganese unavailable as an oxidising agent when dissolved in hydrochloric acid. Since varieties of manganese ore do contain the iron compounds of which we have spoken, we did not further investigate the question whether or no this was the only cause of the two high results which this method yields under certain circumstances. The reason of the uncertainty of the results obtained by the iron method, as, also, of their being generally too low, we discovered to be, that a slight loss of chlorine generally takes place during the operation. When the manganese is added to the protochloride solution, a greater or less quantity frequently floats on the surface of the liquid for a short time. A small quantity of chlorine is evolved from this, which has no opportunity of acting on the iron solution, and is carried off with the stream of carbonic acid. We convinced ourselves that this was the case by conducting the escaping gas into a second flask, which contained a small quantity of weak protochloride of iron solution. As soon as the manganese rose to the surface of the liquid in the decomposing-flask, a yellow colour appeared in the liquid in the second flask, proving that a portion of the chlorine from the manganese escaped into the second flask, and there formed a sesquichloride of iron. The contents of the two flasks were then separately tested with the chromate of potash solution. From the first flask alone, the sample would seem to contain 2 per cent less than it actually does contain.

0·8129 grms. manganese.	
1·06519 grms. pure iron in first flask.	
25·8 c.c. chromate of potash used for first flask	60·48 per cent
0·989 grms. pure iron in second flask	
57·02 c.c. chromate of potash used for second flask	1·99 per cent
	62·47 per cent

This figure agrees tolerably well with the result obtained by Bunsen's method. This method can, therefore, be made to yield accurate results, but only by a difficult and troublesome arrangement, which makes it more complicated and longer than that of Bunsen. Instead of metallic iron, a proto-salt—such as the double sulphate of iron and ammonia—is sometimes used in the iron process, and the decomposition of the manganese effected by means of weak sulphuric acid. No loss of gas probably takes place in this method. Experience has shown us that it is very difficult to obtain such salts perfectly free both from sesqui-compounds of iron and moisture. We did not, therefore, experiment on this method.

The reason of the great irregularity in the results obtained by the chloride of lime method is easily perceived. At 40° C., chloride of lime commences to be decomposed into chlorate of lime; so that a greater or less speed in the evolution of the gas will produce a greater or less warmth in the milk of lime, and, consequently, more or less decompose it. We endeavoured, by external cooling, to prevent this warming and decomposition, but with no satisfactory results, as the following figures will show. The milk of lime was cooled by the external application of a mixture of sulphate of soda and hydrochloric acid.

	AsO_5. c.c.	per cent.
(1). 0·3633 grms. manganese	18·90	= 63·80
(2). 0·7778 ,, ,,	38·45	= 60·64
(3). 0·8185 ,, ,,	40·50	= 60·70
(4). 0·9204 ,, ,,	46·25	= 61·64
(5). 0·6975 ,, ,,	35·65	= 62·69
(6). 0·5581 ,, ,,	26·85	= 59·01

This method can, therefore, only be used for approximate results.

In estimating the manganese by the method of Bunsen, the iodine liberated by the chlorine should be tested as soon as possible after the decomposition. The iodine solution from the tests numbered 1 and 2 were again tested after standing twenty-four hours. The results were both over 65 per cent. This was caused by the conversion of iodine into hydriodic acid. In conclusion, therefore, we may decide that the results obtained by Bunsen's method exceed all others in accuracy. Its simplicity, also, is greater than that of the iron method, as it requires only one weighing, and does not need a stream of carbonic acid. At the mines where tests continually have to be made, the method of Fresenius and Will would certainly appear to be the best and simplest, so much the more that here no accidental admixture of iron can have taken place.

In conclusion, we would suggest that it is more reasonable to represent the value of manganese rather by chlorometrical degrees than by the percentage of binoxide. Neither the method of Bunsen nor the iron method represent the percentage of binoxide, but the relative value of the ore as an agent for the production of chlorine; and, therefore, a similar form of expression for the value of chloride of lime and manganese, seems to us desirable.

Wiesbaden, Oct. 11th, 1869.

PS. The foregoing paper is the result of experiments made at the laboratory of Dr. R. Fresenius, in Wiesbaden.

ON SOME

TECHNICAL APPLICATIONS OF THE SPECTRUM MICROSCOPE.*

By H. C. SORBY, F.R.S., &c.

(Continued from p. 296.)

Adulterations of Wine.

The only cases in which the spectrum method can be easily applied to detect adulterations in wines are when some colouring matter has been introduced to give a false appearance of age, or to bring the colour up to some desired standard. According to Payen's interesting work,† logwood and Brazil wood were at all events employed a few years ago for this purpose; and rhatany root and the berries of the so-called *Virginian Poke* (*Phytolacca decandra*) are sometimes used. I mention these because I purpose to briefly describe how they may be detected, as an illustration of the methods which may be employed in such investigations. I must, however, confess that I have not detected these substances in any wines of commerce that I have yet examined; but then I have had very little opportunity for studying those likely to contain them.

In order to detect logwood or Brazil wood, a small quantity of the wine should be agitated in a test-tube with an equal volume of ether, which rises to the surface in an almost colourless state if the wine be pure, but is tinged with a more or less strong yellow when either of the above-named substances is present. The etherial solution should be transferred to a small evaporating dish by means

* Communicated by the author, having been published in the *Quarterly Journal of Microscopical Science*, vol. ix., new series, p. 358.

† "Précis des Substances Alimentaires," note at p. 455.

of a pipette, and a fresh quantity of ether agitated with the wine, and added to the other. The most useful kind of pipette for this and similar purposes is one with a small vulcanised india-rubber top, so arranged that, after having been compressed, it may, by its own elastic force, draw up the liquid. After evaporating the solution to dryness, a small quantity of the colour should be dissolved in water in an experiment cell, and treated with bicarbonate of ammonia. In both cases this developes a single very distinct absorption band in the green, that characteristic of logwood being situated at 4⅛ of my scale, whilst that of Brazil wood is farther from the red end, at 5¼; and the solution is strongly fluorescent, of a peculiar orange colour. These spectra are so characteristic, and can be so easily compared with those of the substances themselves, that an extremely minute quantity of either could be detected with certainty.

The colour of rhatany root does not give any well-marked band in an aqueous solution, either acid or alkaline; but when dissolved in alcohol and slightly acid, it shows a moderately distinct band between the yellow and green, at 3⅜ of my scale, and a fainter at 7¼. In order to detect this substance the wine should, therefore, be evaporated to small bulk, and re-dissolved in strong alcohol, and after this has stood in a test-tube until the insoluble matter has been deposited and the solution has become quite clear, the absorption band at 3⅜ may be more or less distinctly recognised, according to the amount of the rhatany root present; but the natural colour of the wine makes it impossible to detect a very small quantity.

The dark crimson berries of the Virginian poke are remarkable for containing a colour belonging to my group C; whereas those of nearly all fruits of that tint belong to group B. It shows two absorption bands, which are more distinct in an alcoholic than in an aqueous solution, and are 4⅛, 7⅛. To detect this substance we ought, therefore, to adopt the same process as in the case of rhatany root, and endeavour to see those bands, which might sometimes be made more distinct by adding a little water and sulphite of soda.

These substances may be changed by keeping long in solution, and therefore might not be detected in old wines.

On the Application of the Spectrum Microscope to the Chemistry of Beer.

In studying the colouring matters in beer, it is, in the first place, desirable to understand those met with in the various substances used in brewing; but it is unnecessary to take into consideration colours insoluble in water.

When malt is digested in hot water, an orange-yellow colouring matter is extracted; but the solution contains so much sugar and gum as to interfere with the necessary experiments. It should, therefore, be evaporated to the consistency of syrup, alcohol added by degrees, and the precipitated gum and sugar well stirred up, so that as much colouring matter as possible may be dissolved. After standing till quite clear, this solution, on evaporation, yields a pale orange-yellow syrup, which, when dissolved in water or alcohol, gives a spectrum without any decided characters. Ammonia makes it a deeper and brighter yellow; and the same change occurs when it is dissolved in sulphuric acid. In all these experiments, a mixture of equal volumes of the concentrated acid and water should be used; for, if much stronger, it chars vegetable substances, and, if weaker, it does not act well with the reagents added to it. When dissolved in this, the colour of malt is made much darker by the addition of nitric acid or chlorate of potash; but an excess of the latter makes it rapidly fade to a pale yellow, whilst hypochlorite of soda, in small quantity, makes it somewhat more orange, and more makes it a very pale yellow. The characteristic test is hypochlorite of soda, added to an aqueous or alcoholic solution in which a little citric acid has been dissolved. The addition of a suitable quantity of the hypochlorite turns the aqueous solution to a pink flesh-colour, becoming deeper; but it is not clear, and, on standing, a copious pink flocculent deposit subsides. When seen to the greatest advantage, the spectrum is 4 . . . 8 . . 10 . . 11—, without any decided narrow absorption bands. If, however, the colour was dissolved in alcohol, the solution remains clear; there is a well-marked band at the yellow end of the green, which at first is 4⅜, and, as the colour becomes deeper, is more distinct, and rises to 5. The flesh-coloured deposit from the solution in water is easily dissolved by alcohol, and gives the same spectrum; and these facts are so unique that this colouring matter could be easily recognised in complicated mixtures. It certainly does not occur in barley, and must, therefore, be formed in the process of malting. Water extracts from barley a brown colour, insoluble in alcohol, which exactly corresponds with that of liquorice; and also a yellow colour, soluble in spirit, which does not exactly correspond with that obtained from hops, but yet differs from it in such a manner that, taking all the facts into consideration, it seems probable that it is the same colour in a less pure condition.

When hops are boiled in water, the solution evaporated, and the gum, &c., removed by alcohol, as already described, an orange-yellow colour is obtained which, in general appearance and in its behaviour with most reagents, is extremely similar to that from malt. It may, however, be easily distinguished by the action of hypochlorite of soda; for, when this is added to an aqueous solution previously treated with a little citric acid, it merely changes it to a very pale yellow, without any shade of pink. This colour, or, at least, colours, which I have not been able to distinguish from it, is met with in several kinds of faded leaves, stems, and roots, and seems to be very generally distributed.

When the partially-charred malt used in brewing porter is digested in water, a dark solution is obtained; and, on evaporation to small bulk and treatment with alcohol, nearly the whole of this dark colour is precipitated along with the gum. To obtain it more pure, it may be re-dissolved once or twice in a little water, and re-precipitated by alcohol. When dissolved in water, it gives an orange-brown solution, with a spectrum . . . 4 . . 5 . . 6—, made somewhat darker by ammonia; and, when dissolved in sulphuric acid, the colour and spectrum are nearly the same. Oxidising reagents do not make it any darker in either solvent, but merely cause it to fade to a pale yellow.

Besides this dark colour, highly-dried malt contains an orange-yellow, soluble in both strong alcohol and water. This differs from that obtained from pale malt, in not being turned at all pink by the action of hypochlorite of soda, and is distinguished from the colouring matter of hops or of beer (with which it agrees in general colour) by not being made at all darker by the addition of oxidising reagents to the solution in sulphuric acid, as if it were already in an oxidised condition.

Liquorice is chiefly coloured by a brown substance, which closely resembles that present in dark malt. When alcohol is added to the strong aqueous solution, it is precipitated in the same manner; and when dissolved in water the general colour is very similar, though rather more orange. They may, however, be easily distinguished by the action of oxidising reagents. If to solutions in sulphuric acid of equal depth of colour equal quantities of chlorate of potash be gradually added, the malt first becomes a much paler orange, and then pale yellow; whereas the liquorice turns to an orange, which does not become pale until very much more chlorate has been added than suffices to make the malt very pale. Though they can thus be easily distinguished, yet when mixed together, as in porter, it is not easy to obtain decided results. The change of colour is very similar in kind, and differs only in degree; so that the addition of too much chlorate may make the liquorice as pale an orange as the malt; and

when not much liquorice occurs mixed with malt, it becomes very difficult to recognise it. Still, however, with care its presence may be detected in ordinary porter.

That colouring matter of porter which is soluble in strong alcohol behaves with reagents like a mixture of those from beer and dark malt. Hypochlorite of soda turns the solution in sulphuric acid to a red, but of a less deep tint than in the case of beer.

The sweet wort obtained in brewing contains the colour of malt, already described, and, after boiling with hops, the hop colour; but after fermentation a change is found to have occurred, which proceeds still further when the beer is kept in the barrel. This change is best shown by the addition of hypochlorite of soda to the solution of the colouring matter in sulphuric acid. The gum, &c., should be removed by means of alcohol, in the manner already named when describing malt. Taking two experiment cells, and dissolving in one the colour of the unfermented wort, and in the other an equal quantity of the colour of beer that has been kept some months in barrel, the general tint is seen to be very similar. Since the solutions are otherwise apt to be turbid, it is best to fill the tubes three-fourths with the sulphuric acid diluted with an equal bulk of water, and then to fill up with alcohol, after which the coloured syrup can be added on a platinum wire, and made to dissolve by stirring. On adding little by little hypochlorite of soda to such a solution of the unfermented wort, it first turns it a little more orange, and then pale yellow; whereas, in the case of the beer kept in barrel, it is first gradually changed to a deep pink-red, which, when strong, is 3 - - 4—, and, when seen to the greatest advantage is 5 - - 7½ . . . 9½ - - 10—, having, therefore, a broad absorption band at 6½. On adding more hypochlorite it becomes more orange, and finally an orange-yellow. The fermented wort behaves in an intermediate manner; and hence it should appear that the change begins during fermentation, and is continued when the beer is kept in barrel. Still, however, it does not seem to depend simply on fermentation, since no such change occurs when fermented on a small scale; and, therefore, it may perhaps be due to deoxidisation, which would be more likely to take place in a large quantity less exposed to air.

If in any case it were desirable to ascertain whether or no any mixed liquid contained beer, the various reactions with the reagents already mentioned might enable us to form a very decided opinion when other tests failed; but so much would depend on the circumstances of the case that no general rule could be given.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 16th, 1869.

Dr. A. W. Williamson, F.R.S., &c., President, in the Chair.

The minutes of the previous meeting having been read and confirmed, the following certificates were read:—

For the first time:—Pedlar, Royal College of Chemistry.

For the second time—James Bell, Howell Hill, Ewell; G. R. Hislop, Gas Works, Paisley; William Ladd, Beak Street, Regent Street; Alfred Bird, Worcester Street, Birmingham; H. Seward, 15 Barnsbury Park, N.; Edwin Lepper, 11, Maiden Lane, Queen Street, Cheapside, E.C.

For the third time—Samuel Jefferson, Secretary to the Yorkshire Board of Education, Woodville Terrace, Woodhouse Lane, Leeds; Clements Higgins, Demonstrator of Chemistry, King's College, London; James John Bourey, Analytical Chemist, 10, Stepney Causeway, E.

The last-named gentlemen were ballotted for and duly elected.

Mr. McLeod gave a verbal account of some experiments he had made on the presence of gases in sea water. At the last meeting he had stated from memory that Thames water contained 6 volumes of gas in 100 of water: on referring to his note-book he found that 100 vols. of this water contained—Nitrogen, 1·398; oxygen, 0·619; carbonic anhydride, 4·180; giving a total of 6·197 vols. in 100 vols. of water. He had experimented upon some sea water collected at Worthing, some distance from the outfall of any river, and which had been exposed to the air for twenty-one months, and found that the amount of gas in 100 vols. was—Nitrogen, 1·104; oxygen, 0·572; carbonic anhydride, 2·620; the total being 4·296. This was very much in excess of the quantity found by Mr. Hunter, as recorded in his paper read at the last meeting, but the quantity of carbonic anhydride was much smaller than might have been expected. The hardness of sea water was greater than that of Thames water, and therefore one would expect a larger quantity of anhydride to have been produced by the distillation. He intended, if possible, to collect some water from the surface of the sea, and to ascertain what quantity of gas it contained.

The President, in thanking Mr. McLeod for his communication, said Dr. Hugo Müller had, he thought, made experiments on the condition of carbonic gas when dissolved in water which led to remarkable results.

Dr. Hugo Müller, in experimenting on the manufacture of soda-water in an apparatus which was formerly much used, found that if the carbonic acid remained in contact with the water for twenty or twenty-four hours, it disengaged itself gradually, adhered to the sides of the glass, and appeared altogether different than when it was left only a short time in contact with the water. He had also noticed that, with the addition of a little common salt, the carbonic acid dissolved much quicker, the chloride of sodium being actually decomposed by the carbonic acid, hydrochloric acid and bicarbonate of soda being formed. He had proved the presence of hydrochloric acid, by ultramarine, which was neither acted upon by carbonic acid nor chloride of sodium. Another instance, in which the chloride was decomposed by carbonic acid, was when carbonic acid was passed through a neutral solution of chloride of lead. In a short time, a clear solution was obtained, and, after a certain time, a precipitate consisting of chloro-carbonate was formed.

Dr. Divers observed that, if rectified spirit were mixed with distilled water which contained air through exposure, a kind of effervescence occurred, which he supposed was due to the formation of minute bubbles of air being liberated and rising to the surface. This seemed to show that a mixture of spirit and water had less solubility for air than pure water itself.

The President wondered if the temperature had anything to do with the peculiar state in which Dr. Hugo Müller found the carbonic acid. He had been looking over Dr. Andrews's experiments on the states of carbonic acid at different temperatures, and it would seem that a few degrees of temperature made a great deal of difference in the proportion of the acid, which was not overcome by enormously multiplying the pressure. The observations on the greater solubility of carbonic acid in water containing sodic chloride he thought of great theoretical value, confirmed as they were by the ultramarine test. He (the President) had held, for years, that salts generally dissolved in water by decomposition, and he was interested to find his view confirmed by the introduction of the ultramarine test for the presence of free hydrochloric acid.

After some further remarks from Dr. Hugo Müller, on the chloro-carbonate of lead reaction,

The President alluded to a reaction he had published twenty-four or twenty-five years ago—viz.,

the action of chlorine in water in the presence of salts like sodic sulphate.

The meeting was then adjourned to January 20th, 1870.

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section).

The ordinary meeting of this section was held on the evening of Tuesday last, Dr. Wallace, F.R.S.E., one of the Vice-Presidents, in the chair. Several new Associates were balloted for and admitted. Thereafter,

Mr. W. R. Hutton, manufacturing chemist, read a paper "*On the Chemistry of Coal-Smoke.*" The author glanced at the subject both in its sanitary and its economical aspects; and then, in order that the scientific principles involved in the prevention of smoke, and in the complete utilisation of the heating power of raw coal, might be properly understood, he gave an analysis of best Wishan coal, one of the finest kinds of fuel in Scotland. It was as follows:—

Water	2·8
Sulphur	0·4
Volatile matter	36·9
Fixed carbon	56·3
Ash	3·6
	100·0

Volatile Matter.

Carbon	14·0
Hydrogen	6·0
Oxygen	15·9
Nitrogen	1·0
	36·9

In the ordinary combustion of coal, black smoke, and therefore soot, is only producible from the volatile matter of the coal, the fixed carbon, ash, &c., being incapable of generating smoke. The value of a fuel as a generator of heat is estimated according to the amount of carbon and hydrogen present in it. As ordinarily used, coal, during its combustion, gives rise to many curious compounds, including carbonic oxide, carbonic acid, watery vapour, ammonia, sulphurous and sulphuric acids, and various hydrocarbons, some of the paraffin series, and others of the naphthalin series; and, as they are volatile when liberated, they rise into the atmosphere and form the mixture known as coal-smoke. This material differs in its properties and composition, according to the composition and mode of burning the coal; but, in all cases, sooty carbon and moisture are abundant, the former especially so in black smoke. But black smoke is soot, and is the result of the imperfect combustion of the coal, and even of its wasteful use. Mr. Hutton then went on to examine soot in its chemical aspects, and explained, in detail, how the difference of temperature in a furnace or domestic fire regulates the composition of the volatile matters of soot. The composition of London and Glasgow soot was shown in a table, of which the following is a copy.

Analysis of Soot.

	London.	Glasgow.
Carbon	53·18	35·7
Tar and oil	18·00	15·0
Ammonia	1·75	2·8
Potash	0·20	0·3
Soda	0·34	0·3
Lime	1·00	0·8
Magnesia	0·30	trace
Phosphate of lime and alumina	2·08	3·2
Iron	0·40	0·7
Sulphuric acid	4·69	7·9
Chlorine	trace	0·4
Sulphocyanogen	0·25	none
Carbonic acid	0·70	trace
Sand	14·40	25·7
Water	2·80	7·2
	100·00	100·0

The author said he could guarantee the genuineness of the sample of London soot; but he was afraid that the Glasgow soot which he had examined was adulterated, judging by the large percentage of sand and water contained in it. The large proportion of sulphuric acid might be accounted for by the sulphurous quality of the Scotch coal, and by the great number of chemical works in Glasgow. Genuine Glasgow soot ought to contain a larger amount of ammonia: both samples were distinctly acid. While referring to the various uses of soot, Mr. Hutton mentioned that a considerable quantity was recently shipped to the West Indies, to be used there for the growth of the sugar-cane. The price is from 30s. to 40s. per ton. Considering that soot rarely contains less than about one-sixth of its weight of hydrocarbon compounds, the author of the paper proceeded to look at the production of soot from a commercial point of view, and asked if the value of soot is proportionate to the evils resulting from the production of the material. Not more than 500 tons are gathered in Glasgow per annum, and the value never exceeds £1000. Taking the waste of fuel, the loss of the nitrogen of the coal, the destruction of property, and the personal discomfort resulting from smoke and soot, he found that there was no profit, but rather a great loss instead. As a practical solution of the "smoke nuisance," Mr. Hutton briefly sketched a plan by which practically smokeless fires might be obtained, while all the volatile compounds could be separately collected, and be got in a form fit for utilisation. He would distil the coal before burning, stopping short the process of distillation at such a stage as would permit *soft coke* to be formed—that is, fixed carbon with a sufficient amount of volatile matter in it to render it slightly inflammable. The other useful products would be chiefly crude oil, coal-gas, and ammonia. Assuming, as a basis of calculation, 2000 tons of coal to be used daily, that amount would yield, in round numbers—

Soft coke	1400	tons.
Crude oil	40,000	gallons.
Ammoniacal water	30,000	,,
Coal gas	6,000,000	cubic feet.

Deducting the ash, the fixed carbon would be reduced to 1329 tons. Mr. Hutton calculated that the coke and the other products would realise £742, while the coal (at 5s. per ton) and the labour, &c., would cost £600, leaving an apparent balance of £142, in addition to all the other advantages which would result from the complete combustion of the fuel. The coke would be such a material as would be available alike for domestic fire-places and the furnaces of steam-boilers, &c.

At the conclusion of the paper, various members spoke in commendation of Mr. Hutton's views. In reply to Mr. Stanford,

Mr. Hutton stated that such coke as he had suggested in his paper could be burned in the ordinary grate, without the expense or any other of the inconveniences attending the use of the grate which was devised some years ago by the late Dr. Neil Arnott.

On the motion of the Chairman, a codial vote of thanks was awarded to Mr. Hutton; and the meetings of the Section were adjourned for a month.

The Faraday Memorial.—The subscriptions to the Faraday Monument Fund, received up to Dec. 7, amount to £1400. The object of the fund is to provide a public memorial to Faraday, and the subscription from one person is not to exceed five guineas.—*Nature.*

NOTICES OF BOOKS.

The Life and Letters of Faraday. By Dr. Bence Jones, Secretary of the Royal Institution. London: Longmans, Green, and Co. 1870. 2 vols., 8vo., with illustrations.

II.

The second volume of this work is divided into four chapters, of which the first treats of Faraday's "First Period of Electrical Research," included between the years 1831 and 1840, and extending to his forty-ninth year. The great discoveries of this period of his life were those of magneto-electricity and of definite electrical decomposition. So early as 1831, we find the germ of the idea of "lines of force"—an idea which pervaded all his succeeding philosophy. "By magnetic curves," he writes, "I mean lines of magnetic forces which would be depicted by iron filings." The first series of his "Experimental Researches in Electricity" was the result of ten days' labour, and was read on November 24th, 1831, at the Royal Society. The full course of these researches, together with the dates, has been so carefully noted by Dr. Bence Jones, in the notice of Faraday which appeared in the *Proceedings of the Royal Society* for last year, that it will be needless to enter into any detail here; moreover, the main facts of these great researches are more or less known to all of us, and require but little description. We may mention that the appendix to Chapter I contains an example of the notes from which Faraday lectured. On one side of a sheet of paper, he was in the habit of setting down the experiments, numbered and in order, and accompanied by divisions of the lecture-hour into intervals of minutes, varying from five to fifteen; on the other side, the notes of subject-matter were written. with figures corresponding to the numbered experiments.

The second chapter includes the years intervening between 1841 and 1844, and is entitled "Rest between the Periods of his Experimental Researches—Swiss Journal—Nature of Matter." The intense mental labour connected with the electrical researches had brought on attacks of giddiness and loss of memory, and for four years Faraday undertook but one research connected with electricity. He entirely rested during one year, even giving up lecturing at the Royal Institution; and he spent three months of this time in Switzerland. The journal which he kept during this period is full of interest, and shows us the character of the man apart from his science; and it may be here remarked that, although we are apt to study this character more in reference to Faraday's great efforts of scientific thought, it is equally worthy of minute study for other reasons, for the humanity, the gentleness, the love of truth, and the consistency, which were such prominent characteristics of the man.

In 1843, the present Emperor of the French, at that time a prisoner in the Fortress of Ham, addressed several letters to Faraday on scientific subjects. We here find the Emperor appearing in an altogether novel light—viz., as the propounder of a new theory of the action of the voltaic pile, which was read to the Academy by M. Arago, but which does not appear to have been received with much warmth. The Emperor, however, shows that he possessed some knowledge of electricity, and his remarks and inferences are by no means superficial. In some of his experiments he required a galvanometer, but could not succeed in constructing one "parceque les aiguilles aimantées furent toujours déviées par l'attraction des barreaux de fer qui entourent mes fenêtres." Sometimes he seems to have thought of applications of voltaic electricity to purposes of war:—"*What is the most simple* combination," he asks Faraday, "to give to a voltaic battery, in order to produce a spark capable of setting fire to powder under water or under ground?"

The third chapter comprises the period between 1844 and 1855, and extends to Faraday's sixty-fourth year; it discusses "Later Period of Electrical Research—Discovery of the Magnetisation of Light—The Magnetic State of all Matter—Atmospheric Magnetism." The discoveries made during this second period of electrical research were published in the eleven series of "Experimental Researches in Electricity" included between the nineteenth and the thirtieth. Although the discovery of the magnetisation of light (which Sir William Thompson has designated "the greatest discovery of this century)" was among these discoveries, Dr. Bence Jones considers that, "great as these discoveries were, they will not at the present time rank with the three great discoveries of magneto-electricity, voltaic induction, and definite electro-chemical decomposition, which made the glory of the earlier period of the 'Researches in Electricity.'"

Here are some remarks drawn at random from various lectures given at the Royal Institution during the year 1845. Speaking of the fineness of gold wire, he said—"Four sovereigns' weight of pure gold could be drawn into a wire long enough to surround the globe." In a lecture on mercury, he said—"Lecture-room, with all its walls, floors, roofs, &c., from top to bottom, and full of people, if standing in a trough of mercury having the same base as the lecture-room, would only raise a column at the sides 17½ inches high." Of the voltaic battery, he said—"This instrument has done—is doing—more in developing the internal molecular powers of bodies, and the unity of the various forces in nature, than any other offspring of human thought." Speaking of evening lectures at the Royal Institution, he said—"As to popular lectures (which at the same time are to be *respectable* and *sound*), none are more difficult to find. Lectures which *really teach* will never be popular; lectures which are popular will never *really teach*. They know little of the matter who think science is more easily to be taught, or learned than A B C; and yet who ever learned his A B C without pain and trouble?" In a letter published in the *Philosophical Magazine* for 1846, in which we find some of Faraday's boldest and grandest speculations, we have one of the many examples of the singular modesty and humility with which, even at the summit of his fame, he propounds a theory. "I think it likely," he says in concluding, "that I have made many mistakes in the preceding pages, for even to myself my ideas on this point appear only as the shadow of a speculation, or as one of those impressions upon the mind which are allowable for a time as guides to thought and research. He who labours in experimental inquiries knows how numerous these are, and how often their apparent fitness and beauty vanish before the progress and development of real natural truth."

In 1855, Faraday concluded his "Experimental Researches in Electricity." They had extended over a period of twenty-six years, and undoubtedly constitute his greatest and noblest work; the ultimate issue and result of the work it is impossible to estimate, each branch of it as left by him, nay, the smallest twig, may be transplanted, until a very forest is the result. It has stimulated, and will stimulate work; it admits of an infinity of applications; above all, it is a grand example of accurate work, combined with accurate thought, with method, with genius, with a refined manipulation, and a subtle mind. Let us glance at the main results of his electrical researches, in the order in which they occur. "The Induction of Electric Currents—The Evolution of Electricity from Magnetism—Terrestrial Magneto-Electric Induction—Identity of Electricity from Different Sources—Conducting-Power generally—Electro-Chemical Decomposition—Electricity of the Voltaic Pile—Induction of a Current on Itself—Static Induction—Nature of the Electric Force—Character of the Electric Force in the Gymnotus—Source of Power in the Voltaic Pile—The Electricity evolved by the Friction of Steam—The Magnetisation of Light, and the Illumination of Magnetic Lines of Force—New Magnetic Actions—The Magnetic Condition of all Matter—The Crystalline Polarity of Bis-

muth, and its relation to the Magnetic Form of Force—The possible relation of Gravity to Electricity—The Magnetic and Dia-Magnetic Condition of Bodies, including Oxygen and Nitrogen—Atmospheric Magnetism—Lines of Magnetic Force, and the Employment of Induced Magneto-Electric Currents as their Test and Measure—The Constancy of Differential Magne-Crystallic Force in Different Media—The Action of Heat on Magne-Crystals—The Effect of Heat upon the Absolute Magnetic Force of Bodies."

This magnificent work was done under conditions of penury; yet, "during a great part of these twenty-six years, the Royal Institution was kept alive by the lectures which Faraday gave for it." Faraday received, during the greater part of this time £100 a-year from the Institution, and nearly £100 as Fullerian Professor. He kept account of his expenditure in research and apparatus literally to the uttermost farthing. Altogether, Faraday laboured for science for fifty-two years, one-half of which time was devoted to the "Experimental Researches in Electricity."

In June, 1862, Faraday gave his last Friday evening discourse at the Royal Institution. The following are the notes which he made for this his retirement from active duties:—

"Personal explanation,—years of happiness here, but time of retirement; Loss of Memory, and *physical* endurance of the brain.

"1. Causes—*hesitation and uncertainty* of the convictions which the speaker has to urge.

"2. *Inability to draw* upon the mind for the treasures of knowledge it has previously received.

"3. *Dimness*, and forgetfulness of one's former *self-standard*, in respect of *right*, *dignity*, and *self-respect*.

"4. Strong duty of *doing justice to others*, yet inability to do so.

"5. *Retire*."

Who among those present will ever forget the intense enthusiasm which was exhibited at the conclusion of the lecture "On Platinum," nearly the last which Faraday gave? "I have desired to retire," he said, "as I think every man ought to do before his faculties become impaired; but I must confess that the affection which I have for this place is such that I hardly know when the proper time has arrived." No victor in the Olympian games, no conqueror ascending in triumph the Capitoline Hill, no *prima donna* in the height of her fame, ever received a more complete ovation.

"For thirty-eight years," says Dr. Bence Jones, "his lectures were the life of the Royal Institution. His singular power of making himself one with his audience was felt in his Juvenile Lectures, in his Theatre Courses, and in his Friday Evening Addresses." His great success as a lecturer may be attributed to his careful attention to strict rules; some of his earlier remarks on lecturing we gave in the first of these notices, the following rules were found among his notes:—

"Never to repeat a phrase.

"Never to go back to amend.

"If at a loss for a word, not to ch—ch—ch, or eh—eh—eh—, but to stop and wait for it. It soon comes, and the bad habits are broken, and fluency soon acquired.

"Never doubt a correction given to me by another."

In addition to this strict attention to rules, Faraday took lessons in lecturing in 1823, and again in 1825 and 1826, before giving his first course of lectures in the Institution.

Dr. Bence Jones closes his admirable "Life of Faraday," by a statement of the chief of the characteristics of the great philosopher, and of the qualities which combined to render him so noble and so good. "As a philosopher, his first great characteristic was the trust which he put in facts. . . . His second was his imagination. It rose sometimes to divination, or scientific second-sight, and led him to anticipate results that he or others afterwards proved to be true." As a man, his first and greatest quality was his truthfulness; the second, his kindness; the third, his energy. "His religion was a living root of fresh humility, and, from first to last, it may be seen growing with his fame and reaching its height with his glory, and making him, to the end of his life, certainly the humblest, while he was also the most energetic, the truest, and the kindest of experimental philosophers. . . . . His standard of duty was supernatural; it was not founded upon any intuitive ideas of right and wrong; nor was it fashioned upon any outward expediences of time and place; but it was formed entirely on what he held to be the revelation of the will of God in the written Word, and throughout all his life his faith led him to act up to the very letter of it.

Much has been said and written about the Faraday Memorial, and the proposition to erect a monument to him in St. Paul's cathedral is being actively advanced. Looking at his many and great works, and at this last record of him, full of his every-day thoughts and actions, we are tempted to repeat the hackneyed, but here infinitely appropriate, phrase "*Si monumentum requiris, circumspice.*" Of Faraday himself we may truly say, "Exegi monumentum ære perennius." Yet there should be some mark of the popular esteem for such a man—and if it takes the form of a statue, it should be among the quick, not among the dead. It should be in the busy world, and in the light of day, that they who pass by may stay, and read, and remember. Whoever enters St. Paul's, must feel the gloomy chill of the vast, silent edifice; all is dull and gloomy, and the surroundings recall to us obsequies, and friends mourning, and the terrors of death. We would not have the statue of Faraday placed here; we would not wish to think of him with sorrow in our hearts and ashes on our heads; but we would have the memorial in our often view, and unencompassed by aught that brings feelings of gloom and unhappiness, in that we shall see him no more. To one who asked him, during his last years, how he was, he replied "Just waiting." Let us think of the old philosopher as he sat by his window at the close of life looking out upon the green trees and fields of Hampton, and delighting in the beauties of that Nature he had loved so fondly. He who had been so strong, so mighty to prevail, was now as a little child. The *lumen purum* of the great intellect which had penetrated the mysteries of Nature as few had ever done before, was flickering, and faint, and dim. *Nunc dimittis*,—"the sweetest canticle of all when a man hath obtained worthy ends and expectations"—is the thought which fills his mind; and as he gazes into the bright world without, the landscape fades almost imperceptibly from his sight, the voice of nature is hushed, and there comes a momentary darkness, the precursor of a perpetual light.

Stereograms of Mars, with a Chart of Mars on Mercator's Projection, and Descriptive Remarks on the Stereograms. By R. A. Proctor, B.A., F.R.A.S. London: John Browning, 111, Minories.

We learn, from Mr. Proctor's remarks, that these stereograms are photographs from the globe of Mars which Mr. Browning constructed in the spring of 1868, the edges of the pictures being softened by hand. Viewed in the stereoscope, they give a singularly real and solid figure of the planet, and will not only afford the astronomer an opportunity of studying Mr. Browning's globe, but will also enable him to test the accuracy of his own observations. In producing these admirable stereograms, Mr. Browning has rendered another important service to the science of astronomy.

The Quekett Microscopical Club.—We understand that Mr. Suffolk will repeat his course of lectures "On Microscopical Manipulation" in January, 1870. Gentlemen wishing for particulars can apply to the Secretary.

LABORATORY NOTES.

AN EXPERIMENT TO DEMONSTRATE INCREASE OF WEIGHT IN COMBUSTION.

THERE are two or three methods given in our text-books of demonstrating the increase of weight in combustion, and recently a novel one was described in the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin* (CHEMICAL NEWS, vol. xx., p. 71). This method consisted in burning iron filings attached to a magnet, the magnet and filings being hung over the pan of a moderately delicate balance. While preparing this experiment, another form of it occurred to me, and this I have found to answer admirably; it has, however, the disadvantage of requiring a supply of oxygen from a bag or gas-holder. The experiment is made thus:—A small patty-pan, or the lid of a tin box, is put in one pan of a balance and counterpoised; then a piece of iron wire, or a knitting pin, is placed on the pan, and this also weighed or counterpoised. The wire is now burnt before the oxy-hydrogen blowpipe, the patty-pan being held underneath the burning wire to catch the globules of iron oxide as they melt off. When the wire is burnt as far as practicable, the patty-pan with the globules of iron oxide and the portion of unburnt wire, is put into the scale-pan, and it will be found there is a considerable increase in weight, due to the oxygen which has combined with the iron.

C. J. WOODWARD, B.Sc.

Midland Institute, Birmingham,
December 20th, 1869.

MISCELLANEOUS.

Royal Institution of Great Britain.—The following are the arrangements for the Friday Evening Meetings before Easter, 1870:—

Jan. 21st. Professor Tyndall, LL.D., F.R.S., M.R.I.—"On Haze and Dust."

Jan. 28th. Professor Odling, F.R.S.—"On Professor Graham's Scientific Work."

Feb. 4th. Professor Ruskin, M.R.I.—"A Talk respecting Verona and its Rivers."

Feb. 11th. W. B. Carpenter, M.D., F.R.S., &c.—"On Temperature and Life in the Deep Sea."

Feb. 18th. William Kingdon Clifford, Esq., B.A.—"On Theories of the Physical Forces."

Feb. 25th. Colonel Sir Henry James, F.R.S.—"On the Results of the Excavations at Jerusalem, and on the Recent Survey of Sinai."

March 4th. E. J. Reed, Esq., C.B., Chief Constructor of the Navy.—"On Iron-clad Ships."

March 11th. Professor Sylvester, M.A., LL.D., F.R.S.,—"On Chance."

March 18th. Peter W. Barlow, F.R.S.—"On the New Thames Tunnel."

March 25th. Professor Rolleston, M.D., F.R.S.,—"On History of the Fourth, Fifth, and Sixth Centuries in England, as Illustrated by Researches into the Modes of Sepulture then Practised."

April 1st. Professor Roscoe, F.R.S.

April 8th. Professor Huxley, F.R.S.

Examination of Petroleum. - We have received from the committee of the Mineral Oil Association, to which Dr. Paul is consulting chemist, a statement of results obtained in the examination of 75 samples of petroleum and other kinds of mineral oil purchased in the ordinary course from retail dealers in the Metropolis, which show—(I.) That one-half of the oil represented by these samples is petroleum within the meaning of the Act (31 and 32 Vict., cap. 56); (II.) That it gives off inflammable vapour at a temperature below that specified by the Act as the minimum for ensuring safety in the stowage and sale of such oil; and (III.) That there is still a very general and habitual disregard of the provisions of the Petroleum Act. A portion of each sample of oil tested has been preserved at the office of this Association.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, December 6, 1869.

This number contains the following original papers relating to chemistry and allied sciences:—

Influence which Water Exercises upon the Double Decomposition of Saline Matter and upon the Thermic Phenomena by which these Decompositions are Accompanied.—M. Marignac.—This paper records the results of a series of experiments made with the view to ascertain, by the measurement of the thermal phenomena, what really takes place in double decomposition when rather dilute saline solutions are operated upon. When water is added to any solution of a salt or acid, a variation of temperature always takes place, which may be an absorption of heat or a disengagement thereof, but which does not exceed 0·2° for solutions of 1-10th, and becomes less for more dilute solutions. This rule is not, however, absolute, because the thermic effect caused by the dilution of sulphuric acid becomes greater with more diluted solutions. The figures 92, 135, 185, 255, express the caloric per equivalent (49), according to the state of the dilution, being 1-10th, 1-20th, 1-40th, 1-80th. The mixing of solutions of two salts which cannot decompose each other gives rise to thermic effects which are less marked. We regret that space forbids us now to enter into more details of this subject.

Reply to Remarks made by M. V. Regnault concerning Thermometers, and the Measurement of Temperature with these Instruments.—M. Bosscha.—The author answers the objections made by M. Regnault, and states that the paper of the latter does not teach anything certain on the indications of the thermometer between 0° and 100°; that M. Regnault considers that differences of 0·2° to 0·3° are insignificant quantities, which are too difficult to estimate, and may be neglected. The greater part of this paper is devoted to the question of the influence of peculiar kinds of glass on thermometers constructed with them.

Remarks on some Matters Relating to Spectrum Analysis.—M. Lecoq de Boisbaudran.—The author, in this paper, gives a preliminary account of the spectrum of the aureola emitted by the positive pole, that of the blue light of the negative pole, and that of the tail of fire (*trait de feu*). It being the author's intention to publish a memoir on this subject, we confine our abstract to this enumeration of contents.

Illumination of Transparent Substances.—M. Soret.—This paper contains, chiefly, observations on the labours made on this subject by M. Lallern, and there is attached to it a short note by M. Chevreul, who points out, in reference to observations made by the author as to the great difficulty of obtaining perfectly pure water, and the effect of that fluid upon glass vessels, that, as far back as the year 1811, he (M. Chevreul) found ammonia in all waters, however carefully distilled, and, besides this, he found it invariably to contain alkaline silicates, derived from its action upon glass, which is, even at comparatively low temperatures, acted upon by water. The eminent *savant* states that the bottles in use in his laboratory are made of green glass, which does not contain lead, and is better fit to resist the action of water, as well as of chemicals.

Researches on the Action of Contact (Catalytic Force of Berzelius).—M. Dubrunfaut.

Normal Quantity of Sugar contained in Wine.—M. Petit.—The author states that he has tested several samples of Bordeaux, Burgundy, Cahors wines, and wines produced in the Departments of du Cher, de la Loire, and de l'Indre, and found that the quantity of sugar contained therein varies from 5 to 0·5 grms. to the litre of wine. No sugar could be detected in old wines. The quantitative estimation of sugar in these fluids is done by the author in the previously decolourised wines (by means of filtration through animal charcoal), and treating the filtered liquid with the well-known Fehling reagent. The sugar may be obtained in the separate state by saturating the wine with lime-water, evaporating to dryness, and treating the residue with alco-

hol at 40° (95 per cent). The sugar is left, on evaporation of the alcohol, and may be used for controlling the Fehling test by means of fermentation.

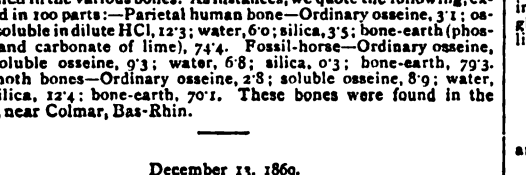
Chemical Composition of Fossil-Bones.—M. Scheurer-Kestner.—This very interesting and lengthy paper contains a series of results of analysis obtained by the investigation of fossil-bones of mammoth horses, and of bones of human skeletons belonging to the earlier centuries of our era. The author points out and proves that chemical analysis can decide the question of the respective ages of bones of various animals found mixed up together, and thus prove that these beings have not necessarily been contemporaneous with each other. This paper contains a large number of tabulated results of analysis made with the special view to careful estimation of the organic matter contained in the various bones. As instances, we quote the following, expressed in 100 parts:—Parietal human bone—Ordinary osseine, 3·1; osseine, soluble in dilute HCl, 12·3; water, 6·0; silica, 3·5; bone-earth (phosphate and carbonate of lime), 74·4. Fossil-horse—Ordinary osseine, 3·9; soluble osseine, 9·3; water, 6·8; silica, 0·3; bone-earth, 79·3. Mammoth bones—Ordinary osseine, 2·8; soluble osseine, 8·9; water, 5·7; silica, 12·4; bone-earth, 70·1. These bones were found in the Lehm, near Colmar, Bas-Rhin.

December 13, 1869.

This number contains the following papers relating to chemistry and allied sciences:—

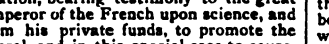
The Siderostat.—M. Leon Foucault.—This paper belongs strictly to astronomy, but the reason why we notice it is that it opens with a brief, but well-deserved observation, bearing testimony to the great value set by His Majesty the Emperor of the French upon science, and the aid given by him, and from his private funds, to promote the labours of scientific men in general, and in this special case to cause, at his expense, the continuation and publishing of the works of the deceased *savant* named at the head of this paragraph.

Constitution of Amygdaline and Phloridzine.—M. H. Schiff.—The author states that when he published a paper on arbutine, he briefly alluded to the subject of this paper, and gives, for the two substances just named, the following formulæ:—

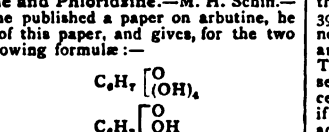


Amygdaline. Phloridzine.

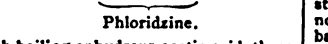
When amygdaline is treated with boiling anhydrous acetic acid, there is formed an heptacetylous amygdaline—



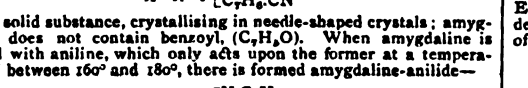
It is a solid substance, crystallising in needle-shaped crystals; amygdaline does not contain benzoyl, (C_7H_5O). When amygdaline is treated with aniline, which only acts upon the former at a temperature of between 160° and 180°, there is formed amygdaline-anilide—



This anilide is not crystallisable, and is very unstable, since, by the addition of boiling water, it is decomposed into aniline and amygdaline. Amygdaline does not contain any ammonia, and is not an amide of amygdalic acid, the formula of which is—



When anhydrous acetic acid acts upon phloridzine, three acetylated derivatives are obtained; one of these is crystalline, the two others are amorphous; they are represented by the following formulæ:—



Acetyl-phloridzine. Triacetyl-phloridzine. Pentacetyl-phloridzine.

Facts respecting so-called Interverted Sugar.—M. Maumené.—This paper is a review of the labours of M. Dubrunfaut on this subject.

Spectrum Analysis, as Applied to the Detection of Gaseous Substances, either when Single or Mixed.—M. Dubrunfaut.—This paper is not suited for useful abstraction; we may give it in full at a future period.

Analysis of the Morallon Kind of Emerald from the Muso Mines (New Granada).—M. Boussingault.—In the carburated schist of Iteco two kinds of emeralds are met with, designated by the appellation *canutillos*, crystallised emeralds always of great value, and *morallones*, amorphous and often fissured stones; of the latter kind the author has had a kilo. to experiment with akin to the first-named species; the colour of the latter varies from very deep green to very pale green, but the morallones are hardly transparent at all. Their sp. gr. is 2·64. On being submitted to strong heat, the loss per cent is 1·92. The analysis of this mineral has, at various periods, given rise, the author states, to some controversy. The older chemists considered that the colour was solely due to metallic oxides. But M. Loewy obtained a large proportion of carbonic acid when he ignited this mineral (the canutillo as well as morallon kind) in a current of oxygen; and he therefore concluded that the colour was due to organic matter. But M. Woehler and other German chemists saw that emeralds kept for an hour at the melting point of copper* did not change colour; and they detected the undeniable presence of oxide of chromium in this mineral. According to the author of this paper, the composition, in 100 parts, of the morallon emerald is:—Silica, 67·2; alumina, 19·4; glucina, 12·7; magnesia, 0·4; with traces of oxide of chromium and lime. Formula:—$Al_3O_3,2SiO_3 + GlO_3,2SiO_3$.

Moniteur Scientifique, No. 312, December 15, 1869.

This number, chiefly filled with a copious index, does not contain any original papers.

Les Mondes, December 9, 1869.

This number contains the following original papers:—

Phosphorescence of the Sea.—M. Duchemin.—This phenomenon, the cause of which has given rise to much speculative discussion, has been thoroughly investigated by the author, who has been occupied with this subject for four years. The results arrived at may be summarised as follows:—The phosphorescence of the sea is solely due to the presence of myriads of very small infusoria (*Noctiluca miliaris*). These animalculæ emit light, produce phosphorescence, whenever they are agitated, either by mechanical means, by heat not exceeding 39°, for a temperature of 41° kills the animals, and after their death neither electricity, nor the action of cold or alcohol, or the addition of an acid to the sea-water, again brings about the phosphorescence. These infusoria are not killed by a strong degree of cold, which seems rather to excite the phosphorescence. An addition of 50 per cent of fresh water to the sea water does not affect the infusoria, but if they are placed in entirely fresh water they are killled. The addition to sea water of alcohol and any dilute acid for a moment greatly excites the infusoria, and a brilliant phosphorescence is the consequence; but the experiment is fatal to them. When the infusoria are kept in perfect darkness for more than a fortnight, they still preserve their faculty of phosphorescence. Electric currents do not kill these beings, which, according to the author, cause to those bathing in the sea sometimes a peculiar exanthema.

December 16, 1869.

Générateurs in explosibles (Steam-Boilers which cannot Explode).—MM. Belleville and Co.—This number contains the description, accompanied by several cuts, which merit the attention of all who have to work with steam, especially of high pressure.

Cosmos, December 4, 1869.

The number contains—

Properties of Vapours (Apparatus Bénévides).—M. Bénévides.—The apparatus, described and illustrated by a cut, is devised by the author with the view to prove the laws of ebullition, the phenomena of latent heat, the influence of temperature upon the tension of vapours, the mode of action of Giffard's injector, the cold produced by the expansion of very high pressure steam when blown off in the atmosphere, the action of steam as a motive power, and the transformation of the heat of combustion into mechanical force.

December 11, 1869.

Biography of Alexander von Humboldt.—Dr. C. Bruhns.—The author states that this work, of which he is the chief editor, will be published in the following manner:—The general scientific biography of the deceased eminent *savant* will be edited by MM. Avé-Lallemant, Dove, Loewenberg, and Foerster. The second section of the work will contain the following sub-divisions, to each of which the deceased contributed largely:—Meteorology and hydrography, Dr. Dove; physiology, Dr. du Bois Reymond; zoology, Dr. Carus; botany and botanical geography, Dr. Grisebach; geology and mineralogy, Dr. Ewald; geography, Dr. Peschel; astronomy and mathematical geography, Dr. Bruhns; natural philosophy and magnetism, Dr. Wiedermann; Humboldt considered as author, Dr. R. Gosche.

December 18, 1869.

Specific Gravity of the Water of the Black Sea.—M. Lapechine.—While the author, as commander of the Russian navy's corvette, *Lwitza* (*Lioness*), was engaged in taking soundings of the depth of the sea above named, he found, at latitude N. 44° 25′ 30″, longitude E. of Poulkowa, 7° 7′, the deepest place, amounting to 1020 toises

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* According to the latest experiments made on this subject by Dr. van Riemsdijk, at the Utrecht Mint, pure copper, kept in a very slow current of pure and dry hydrogen, requires, for fusion, a temperature of 1330° C.

(1 toise = 6 feet and 6 and 9·10ths inches, English measure), the sp. gr. of the water at the surface of this spot was 0·013, while the water from the deeper portions of the sea varied in sp. gr. from 1·0151 to 1·0140. The figure 0·0130, just quoted, is exactly as in the original, but is, presumably, intended for 1·013.

Petroleum Sources near the Caspian Sea.—M. Meunier.—The existence of petroleum in this region of Asia has been known from a remote antiquity, but only of late has this material become utilised; and new borings, made according to the American system, have revealed the fact that, from a depth of 250 feet below the surface, petroleum is forced up so as to spout from 50 to 65 feet above the surface, and to yield quantities amounting to 19,000,000 lbs. annually, while 200,000 lbs. of solid paraffin are obtained from a kind of asphalte, very abundantly met with in this remote region.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, October, 1869.

This number contains the following original papers relating to chemistry or allied sciences:—

Bronze Powder.—Dr. Wagner.—After referring to the history of the first application of the scraps and waste of what is commonly called tinsel, or Dutch gold (none of it was or is ever made in the Netherlands; this industry is confined almost entirely to Bavaria), the author treats of the mechanical means whereby the metal is brought to leaf and powder. There are three chief alloys in use, which are designated by the name of the colour, the composition of these being, in 100 parts:—For the light shade—copper, 83; zinc, 17; for the deeper shade—copper, from 90 to 94; zinc, from 10 to 6; for deep copper-red, no zinc at all. Copper may be obtained in finely-divided state by the following chemical means:—By igniting a mixture of chloride of copper, carbonate of soda, and sal ammoniac; by precipitating a solution of acetate of copper by means of sulphurous acid; by decomposing suboxide of copper by means of sulphuric acid; by electrolysis of a solution of sulphate of copper; by precipitating a solution of the last-named salt by means of a bar of iron wrapped up in filtering paper or coarse cotton tissue; but all the metal thus obtained is hard and crystalline, and unsuitable for the purposes it is intended for as bronze powder. The author found that, when oxide of copper, such as is used for elementary organic analysis, is submitted, hot, to the action of the vapours of ligroine (a light petroleum oil, or spirit), it is obtained in an excellent condition, and 100 kilos. of oxide require, for reduction at red heat, only 8 kilos. of ligroine.

Manufacture of Alcohol from Indian Corn.—M. Bergsträsser.—This paper is of interest only to distillers in countries where Indian corn is grown; the material is very suitable for the purpose, and the refuse remaining after distillation is a valuable food for milch cows, on account of the large quantity of fatty matter it contains.

Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, July and August, 1869.

The papers on chemical subjects in these two numbers have been forestalled by having been published in other German periodicals, from which we abstracted them.

Bibliothèque Universelle et Revue Suisse.—Archives des Sciences Physiques et Naturelles, No. 143, 1869.

This number does not contain any original papers relating to chemistry or allied sciences.

Neues Jahrbuch für Pharmacie, von Dr. F. Vorwerk, October, 1869.

This number contains the following original papers:—

The Doctrines of Modern Chemistry.—Dr. Koller.—This paper contains a very clear review of the doctrines of modern chemistry, as compared with that of some years ago. The contents of this paper are divided into sections with the following headings:—Atomic and molecular weight; type and radical theory; substitution; anhydrides of acids; anhydrides of bases; salts, normal, basic, and acid. The paper is not well suited for useful abstraction.

On Gelatinæ Medicatæ.—Dr. Husemann.—This paper relates entirely to the pharmaceutical preparation of medicated gelatine lozenges.

Lithoreactive.—M. Weiss.—The author states that a mixture containing 5 per cent of sugar molasses, or beet-root syrup, 15 per cent of milk of lime (one part of slaked lime to three parts of water), and 80 per cent of caustic soda lye at 34° Beaumé, sp. gr. 1·039, is the best and surest means of preventing, as well as of breaking-up and dissolving, steam-boiler incrustations, while, moreover, this mixture is perfectly innocuous as regards its action upon either copper or iron. The hardest water only requires 1 kilo. of lithoreactive upon 1800 litres. of water.

Antimonoide.—M. Lichtenberger.—Under this curious name, there is in use a mixture for absorbing the protoxide of iron, while that metal is to be welded in red-hot state. The mixture consists of 4 parts of iron filings or turnings, 3 parts of borax, 2 parts of borate of peroxide of iron, and 1 part of water. The powder is made in the following manner:—To a solution of 3½ parts of borax in water, as much chloride of iron is added as is sufficient to obtain a precipitate of insoluble borate of peroxide of iron; this precipitate is washed upon a filter to remove common salt. This having been done, there is added to the precipitate (previously, of course, put in a suitable vessel) a solution of 3 parts of borax, and this mixture evaporated nearly to dryness, when there is added to it 4 parts of clean iron filings or turnings. The whole is then strongly dried and heated to incipient red-heat, whereby a fusion takes place; and, after cooling, the mass is pulverised.

NOTES AND QUERIES.

Electro-Deposition of Copper upon Cast-Iron.—(Answer to "Histrix.")—Among the many treatises on electro-metallurgy the "Repertorium der Galvanoplastik und Galvanostegie, &c.," von A. Martin, published at Vienna, is one of the best, and contains very ample information on this subject. This work can be inspected at the Patent Office Library.

Specific Gravity.—(Answer to "C. H. Parkin.")—According to Twaddell's scale, 0 is equal to 1000, or the specific gravity of distilled water, and each degree is equal to 0·005; so that by multiplying this number by the number of degrees marked on the scale, and adding 1·0 the real specific gravity is obtained. There are published tabular, forms giving the specific gravity for every degree of Twaddell's hydrometer.

Knife-Edges for Balances.—(1) Is a balance with agate edges as delicate in its indications, and as prompt in its action, as one with steel edges? [A balance with agate edges is as delicate in its indications, and as prompt in its action, as one with steel edges.]

(2) Is a balance with agate edges more liable to get out of order? [It is not so liable to get out of order.]

(3) If there be an advantage in the agate above the steel, is it worth the increased cost?—W. H. D. [Steel rusts in a damp atmosphere, or if kept in laboratory. Agate edges are well worth the extra cost.]

Treatment of Oils for Machinery Purposes.—(Answer to "B. S.")—Oils for machinery purposes, and for lubricating generally, may be purified by agitating them with from 4 to 8 per cent of their weight of a caustic soda lye, sp. gr. 1·2. After twenty-fours' repose, the supernatant oil is decanted from the soapy sediment, thoroughly washed with pure cold water, left to repose, again decanted, and filtered, best through some animal charcoal, such as is used for the filtration of sugar syrups in sugar refineries, and through the woollen tissue, also in use in these establishments. This treatment renders the oils very suitable for the purpose intended, and is quite free from any action on the metals.

Glue and Gelatine.—In reply to the enquiry of "G. G.," he will find every information in the admirable articles "On Gelatine and Glue," in Dr. William Allen Miller's "Elements of Chemistry," where the subject is thoroughly treated. I just add a test for the goodness of glue, which I have found very valuable. Assuming that "that" is the best glue which will take up most water—Take 50 grs. of the specimen, and dissolve it in 3 ozs. of water in a a water-bath. When dissolved, set it by fo 112 hours, to gelatinise; then take a 1 oz. chip box, place it on the surface of the gelatine, and put "shots" into the box, till it sinks down to a "mark" on the outside. It will be found that, the stronger the glue, the more shots it will take to sink the box down so that the mark shall be level with the surface of the gelatine. In a trial with Mitchell's glue, which is made here, and is the finest I ever met with, 50 grs. of glue, dissolved and gelatinised, with 3 ozs. of water, supported, to the mark on the box, 6 ozs. of shots, at a temperature of 58° F. On trying the same experiment with best Russian isinglass, 50 grs., dissolved in 3 ozs. of water, supported 9 ozs. of shots, the temperature being the same. Russian isinglass, therefore, is one-third stronger than glue in gelatinising power; but, as Russian isinglass is worth £84, and best glue is worth but £3, the cwt., there is no fear that the former will ever supersede the latter.—ALFRED BIRD, Birmingham.

MEETINGS FOR THE WEEK.

TUESDAY, 28th.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

THURSDAY, 30th.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

SATURDAY, Jan. 1st, 1870.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

TO CORRESPONDENTS.

*** *Owing to our weekly Enclycopædic List of Foreign Papers connected with Chemistry and Physical Science having so materially enlarged the Contents of the* CHEMICAL NEWS, *we are compelled to issue the Index as a Supplementary Number. It has been compiled with great care, and with our copious abstracts of all the important papers, may be said to form an English edition of the "Jahresberichte." With the commencement of our new volume we intend to improve the appearance of the* CHEMICAL NEWS *by printing it on paper of a much better tone and quality.*

THE CHEMICAL NEWS.

VOL. XX. No. 527.

CAUSE OF BRIGHT LINE ON PARTIAL-PHASE ECLIPSE PICTURES.*

By Professor HENRY MORTON.

DURING the progress of the eclipse of August 7th, I observed on the negatives, taken during the partial phase by the section of my party with which I had located myself, a decided increase in the opacity of the silver deposit in immediate contact with the advancing edge of the moon. When, after our return to Philadelphia, all the negatives taken by the other two sections were handed over to me, I found the same characteristic appearance, varying only slightly in degree, to distinguish all of them, and this had, of course, been noticed by those engaged in making the pictures. In fact, many remarks have been made upon this point, and some deductions drawn from it.

On the paper prints prepared from these negatives this local density produced a line of light in contact with the moon's limb.

An appearance similar to this had been observed by Professor Alexander, in the photographs taken during the eclipse of 1860, as also by Mr. De la Rue, and while ascribed by Professor Challis and Professor Alexander to a very rare lunar atmosphere, had been explained by Mr. De la Rue and the Astronomer-Royal, as a subjective effect.

The Astronomer-Royal had, moreover, shown, in papers published in the *Monthly Notices* of the Royal Society, 1863, Nov. 13, and 1864, June 10, that no such effect would be produced by a lunar atmosphere, were it present. He, therefore, very justly discards such a supposition, and, by satisfactory experiments, shows that the light line in *the prints under his examination* is an optical illusion, and not an existing fact.

These experiments, however, when applied to good prints of our pictures, did not show the same result, and, beside, the actual opacity of the negatives seemed to preclude the above explanation as one accounting for the *entire* effect.

I therefore made the following experiment:—I converted one of the solar pictures, taken soon after first contact, into a crescent, by pasting partly over it a dark circular piece cut from another print. This showed a faint line of light, such as results from contrast, and which was no doubt found in the pictures examined by the Astronomer-Royal.

I then had this artificial eclipse-picture photographed (through the kindness of Mr. James Cremer), when negatives were produced showing a dense deposit along the lunar edge, and giving prints which showed a bright line in the same place, far more decided than that seen in the artificial original.

It thus appears that the effect observed in these eclipse pictures, while not due to any lunar inflection of sunlight, is also not due to an optical effect of contrast solely, but is, in great part, due to a chemical action, which may be explained by what we know of the chemical reactions concerned in the production of a negative.

It is well known that the development of a negative depends upon the presence of free nitrate of silver in the film, and that a great strengthening or intensifying may be produced by re-immersion in the silver bath, and a second application of the developer. Now, in the present case, part of the plate representing the dark edge of the moon, and, therefore, not acted upon, furnishes a reservoir of nitrate of silver, imbibed by the collodion film, which, during the development, penetrates for a short distance into the portion representing the *luminous* area of the sun whose supply of free nitrate was exhausted by the reaction which occurred at the first moment when the developer was applied.

My conclusion, then, is, that while a certain effect in the paper prints is, and was on former occasions, due to "contrast," yet, in the present instance, the peculiar appearance of the negatives, and most of that seen on the prints, is the result of a chemical action such as I have described, and does not represent any celestial phenomenon. The *appearance* of a bright line in the same place which has been noted by several observers is, we believe, due simply to the contrast of the sharply-defined lunar edge, which produces the faint line above mentioned, in the artificial eclipse picture before described.

* Communicated by the Author.

ON THE

CONSTITUTION OF THE COMPOUNDS OF SODIUM.

By J. ALFRED WANKLYN.

II.

IN this paper I propose to consider the function of sodium in the common compounds of the metal, and to enquire how far the ideas derived from the study of its organic compounds mentioned in the former paper are applicable to its common, well-known inorganic compounds.

Viewed in these organic compounds, sodium appeared as the representative—not of hydrogen, but of nitrogen; the task before me is, therefore, to represent, if possible, the inorganic sodium compounds as modelled on the plan of the compounds of nitrogen.

As I have already stated on various occasions, common salt admits of being looked upon as a sodium compound of the second order of complexity, thus:—

$$Cl\ Na''' ____ Na'''\ Cl$$

and obviously a similar device might be applied to other well-known sodium compounds, such as the numerous soda salts.

I do not, however, propose to avail myself largely of a hypothesis of this kind on the present occasion, and am able to represent the metal as *undoplicated*, and, at the same time, trivalent in most of the compounds in question.

The following list of formulæ will speak for itself:—

Caustic soda	Na'''	$\left\{\begin{matrix}O''\\H\end{matrix}\right.$
Nitrate of soda ..	Na'''	$\left\{\begin{matrix}O'\\(NO_2)'\end{matrix}\right.$
Acetate of soda ..	Na'''	$\left\{\begin{matrix}O''\\(C_2H_3O)'\end{matrix}\right.$
Sulphate of soda ..	Na'''	$\left\{\begin{matrix}O'' \quad O''\\-(SO_2)''-\end{matrix}\right\} Na'''$
Acid sulphate of soda	Na'''	$\left\{\begin{matrix}O''\\-(SO_2'')-(OH)\end{matrix}\right.$
Bleaching soda ..	Na'''	$\left\{\begin{matrix}(OCl)'\\Cl\\H\end{matrix}\right.$
Hypochlorite of soda	Na'''	$\left\{\begin{matrix}O''\\Cl\end{matrix}\right.$
Sulphuretted soda	Na'''	$\left\{\begin{matrix}S''\\H\end{matrix}\right.$
Common salt	Na'''	$\left\{\begin{matrix}Cl \quad Cl\\\hline\\\hline\end{matrix}\right\} Na'''$, or Na_2Cl_2
Anhydrous oxide of sodium ..	Na'''	$\left\{\begin{matrix}-O-\\\hline\\\hline\end{matrix}\right\} Na'''$, or Na_2O

Sulphuret of sodium $Na'''\left\{\begin{matrix}-S-\\---\\---\end{matrix}\right\}Na'''$, or Na_2S

Bromide of sodium $Na'''\left\{\begin{matrix}Br\ Br\\---\\---\end{matrix}\right\}Na'''$, or Na_2Br_2

Iodide of sodium .. $Na'''\left\{\begin{matrix}I\ \ I\\---\\---\end{matrix}\right\}Na'''$, or Na_2I_2

Amide of sodium .. $Na'''\left\{\begin{matrix}(NH)''\\H\end{matrix}\right.$

Nitride of sodium $(Na_3)'''N'''$

The list might be indefinitely extended, so as to exhibit the constitution of a host of double chlorides, bromides, and iodides. I will, however, content myself with formulating the Nessler reagent :—

$$Na'''\left\{\begin{matrix}(HgI)'\\I\\I\end{matrix}\right.$$

and will leave the rest to the imagination of my readers, who will find no difficulty in comprehending that to the new theory belongs the merit of rendering account of the vast number of double haloid compounds containing the alkali metals, which, according to the prevalent notion that the alkali metals are analogues of hydrogen, are regarded as mere freaks of nature, and as much as possible put out of sight.

Reverting to the new formula for caustic soda :—

The fact that caustic soda is volatile is an argument in favour of taking a single rather than a duplicate formula for that substance. (Possibly it will be found that when chloride of sodium seems to volatilise it really undergoes change into trichloride of sodium and metallic sodium—a view which is in harmony with various facts, notably, with the extraordinary power of chlorine to facilitate the volatilisation of metallic chlorides.)

According to the new theory, the action of sodium on water is as follows :—

$$Na''' + \left.\begin{matrix}H\\H\end{matrix}\right\}O = HNa'''\left\{\begin{matrix}O\\H\end{matrix}\right.$$

According to the theory at present in vogue, this reaction is thus :—

$$Na' + \left.\begin{matrix}H\\H\end{matrix}\right\}O = \begin{matrix}H\\Na'\end{matrix}\left\{\begin{matrix}O\\H\end{matrix}\right.$$

The new theory, therefore, represents sodium as doing more than twice the amount of chemical work that is done by the metal according to the old theory. Instead of displacing one atom of hydrogen, sodium really displaces two atoms of hydrogen, and also combines with one of the displaced atoms. Hence the extraordinary quantity of heat generated by the action of alkali metals on water.

The ordinary theory of caustic soda, as a member of the water-type, is beset with difficulties and inconsistencies of many kinds. Why should caustic soda be so active a chemical reagent as it is? If alcohol and caustic soda be both of them built on the water-type, why should the former be so inactive and the latter so very active.

The new theory renders account of the energy of caustic soda. According to it this substance is, in one-third of its structure, the hydride of sodium, and, therefore, naturally endowed with abounding energy.

Berthelot's splendid discovery of the synthesis of formiate of soda is beautifully in harmony with the new theory :—

$$CO + Na'''\left\{\begin{matrix}O''\\H\end{matrix}\right. = Na'''\left\{\begin{matrix}O''\\COH\end{matrix}\right.$$

The production of bleaching soda, and, generally, oxidation under the influence of alkalies, are quite natural changes suggested by the very formulæ of the new theory :—

$$Cl_2 + Na'''\left.\begin{matrix}O''\\H\end{matrix}\right\} = Na\left\{\begin{matrix}Cl\\(OCl)'\\H\end{matrix}\right.$$

London, Dec. 24, 1869.

ON SOME

TECHNICAL APPLICATIONS OF THE SPECTRUM MICROSCOPE.*

By H. C. SORBY, F.R.S., &c.

(Concluded from p. 306.)

On Some Adulterations of Malt Liquors.

I HAVE made very many experiments in order to ascertain how far the spectrum method can be employed in detecting adulterations in beer. Many of the substances used are added in such quantities, and impart so little colour, that there seems to be no chance of discovering them by their spectra. I have chiefly directed my attention to those employed as substitutes for hops, such as picric acid, gentian root, calumba root, and the entire plant of *Ophelia chireta*, commonly known by the more simple name of chiretta. So far I have not been able to detect any difference between the colouring matter of gentian, or chiretta, and hops. They all give the same reactions and spectra with the various reagents, or at least so nearly the same that there appears to be no chance of detecting them in the presence of the colouring matter of wort or beer. Calumba root, however, contains two colours, one of which is quite different from any that should occur in genuine malt liquors. The exterior part of the root is yellow, and water extracts from it a bright yellow colour. The interior part is browner, and does not contain this yellow, but a browner colour, which also occurs to some extent in the outer layer. On evaporating the aqueous solution to small bulk and re-dissolving in alcohol, this brown colour is left insoluble, but the bright yellow colour remains in the alcohol in a curiously turbid condition. The brown colour appears to be identical with that found in liquorice, and could not be detected by any of the reagents; but the yellow colour may be recognised, if beer has been adulterated by a moderate amount of calumba root. When dissolved in water or alcohol it is a very clear, bright yellow, but gives no well-defined spectrum. Ammonia makes it slightly orange, and when dissolved in sulphuric acid, it is the same bright yellow as in water. Oxidising reagents, such as hypochlorite of soda, produce no change in weak acid solutions; but when added to the solution in sulphuric acid they alter it into a deep red colour, changed into an orange-yellow by excess. Deoxidising reagents, such as hyposulphite of soda, restore the deep red to the original yellow. The most useful test in connection with the various other colours already described is hypochlorite of soda gradually added to the solution in sulphuric acid. This first makes it a deep red, giving the spectrum 3 . . 4 - —, and the addition of a little more produces scarcely any further change; but when large excess has been added it fades to an orange, giving the spectrum 6 . - 7 —. The colouring matter of fresh wort treated in the same manner is not turned at all red, and though the colour of finished beer is changed to red in a very similar manner, yet, after so much hypochlorite has been added as to turn it deep pink-red, a very little more makes it pale yellow. We may take advantage of this circumstance to detect calumba root.

In examining any suspected beer, it, and a similar quantity of genuine, should be evaporated in separate dishes, so that the results may be more accurately compared. The presence of calumba root is first somewhat betrayed by the fact of the resin, which separates on evaporation, being abnormally yellow, and when the syrup is dissolved in alcohol, and the solution evaporated to dryness, the purified colour is decidedly brighter yellow than it ought to be. Taking, then, two experiment cells, so much of the colour of the genuine beer should be dissolved in one—in

* Communicated by the author, having been published in the *Quarterly Journal of Microscopical Science*, vol. ix., new series, p. 358.

sulphuric acid—as to give a decided orange yellow, with a spectrum 5 . . 6 - - 7—; and in the other cell so much of the suspected material as to give a colour of about the same tint. In both cases, about one-fourth of the bulk of the liquid should be alcohol, so as to prevent the formation of any precipitate. Hypochlorite of soda should then be added very gradually, and in equal quantities to both, when at first both will change to red, having a pinker tint in the genuine. After so much has been added as to make both as dark as they can become, a little more will turn the genuine to a pale yellow, giving a spectrum 7 . . 8 - - 9—; whereas that containing calumba root will remain a fine red orange, with a spectrum 3½ . . 4½ - - 5—. If too large a quantity of the hypochlorite be added, the colour of the calumba root will change into a much paler yellow, scarcely differing from that in the case of genuine beer, and hence particular care must be taken to add it gradually, and in small quantities. By this means, the adulteration of beer with 2 ozs. of calumba root to the gallon may be detected with confidence; but much less than that would scarcely give reliable results, unless it were possible to examine the unfermented wort. The addition of the hypochlorite to genuine wort does not turn it at all red, and merely alters it to a pale yellow; whereas, if calumba be present, it turns it to a decided red.

Picric acid may be detected when present in no larger quantity than 1 grain to a gallon. When dissolved in water, it is of a bright yellow colour, and cuts off the blue end of the spectrum in a sufficiently well-defined manner, giving the spectrum 8½ . . . This is not changed by ammonia or citric acid, nor does hypochlorite of soda cause it to fade when added to an acid solution. The most striking change is that produced by the addition of sulphuric acid, which makes it so much paler that a couple of drops added to the aqueous solution in one of the small cells leaves it nearly colourless. In order to detect it in beer, about 1 oz. should be evaporated to dryness, and then re-dissolved in no more water than will make the solution sufficiently liquid to allow bubbles to rise readily through it. This should be introduced into a test-tube and agitated with ether, which dissolves out the greater part of the picric acid, but scarcely any colour, from genuine beer. Since it is very important to avoid contamination with any of the material not soluble in ether, it is well, in the first case, to use somewhat more than the bulk of the concentrated beer, and to transfer it to another *perfectly dry* test-tube, then agitate with a fresh quantity of ether and add it to the first, arranging so that the total amount of ether may fill a ½ inch test-tube to the depth of about 2 inches. After corking it up, it should be allowed to stand till quite clear, and till any particles not soluble in ether have adhered to the sides of the tube. The clear solution should then be poured off into another tube, water added so as to give a depth of about half an inch, and well agitated with the ether. After it has collected at the bottom, the ether should be removed by a pipette, the aqueous solution washed with a little fresh ether, and then evaporated to dryness. In the case of genuine beer the ether extracts scarcely any colour, and the greater part of this and the resinous matter afterwards remain in the ether, so that on evaporating the aqueous solution, which is scarcely coloured, a mere trace of a yellow colour is obtained, so free from resin that, when dissolved in water and a drop or two of alcohol added, we obtain a clear, very pale yellow solution, so pale that if one ounce of beer has been used, the spectrum is about 10 . . 11.—, changed to about 9 . . 10 - - 11 — by sulphuric acid. If, however, picric acid be present, the solution in ether is a decided clear bright yellow; the greater part of the colour is extracted from it by the water, and on evaporating to dryness more or less of a clear bright yellow is obtained. If as little as a grain per gallon were present, when dissolved in water with a drop of alcohol, a clear bright yellow solution would be obtained, giving the spectrum 8 . . . made much paler by the addition of sulphuric acid, which decolourises the picric acid, and merely shows the colour of the beer itself, which, if one ounce had been used, and all the product introduced into the experiment cell, would not be deeper than 9 . . 10 - - 11—, or very decidedly paler than what would be seen before the addition of sulphuric acid, if even less picric acid than one grain per gallon had been present in the beer.

I have not been able to discover any essential difference between the colouring matter of *Cocculus Indicus* and that of liquorice; and though it would be difficult to prove it in a positive manner, yet I think it very probable that a small quantity of this colouring matter is the cause of the brown colour of chiretta, and of the slightly brown tinge in hops. It would, therefore, be impossible to detect *Cocculus Indicus* in porter by means of its colouring matter, even if present in far larger amount than is ever likely to be the case.

Though the detection of turmeric in beer does not necessarily depend upon the spectrum microscope, yet the method employed is so closely related to our present subject that it may be well to describe it. The best test for its presence is the very strongly fluorescent character of the solution in benzol. The alcoholic solution is much less fluorescent. In order to be able to detect fluorescence and examine the spectrum of the dispersed light, I have found it very convenient to make use of cells about three-quarters of an inch deep, made out of moderately thick barometer tube, having an internal diameter of about one-sixth of an inch, cut square, and polished at one end, and melted up at the other, which is fixed into a small brass foot by means of black sealing-wax. On introducing a clear solution, covering it with a small piece of thin glass, illuminating the tube at the side by strong daylight, and looking down the axis, the liquid appears quite black, if it be not at all fluorescent, for no light is reflected from either the apparatus or the liquid; whereas, if fluorescent, it looks more or less opaque and of a colour depending on the nature of the substance. Such tubes can easily be placed on the stage of the microscope, and the spectrum observed, which, in some instances, is remarkable in showing one or more narrow bright bands.

In the case of turmeric, a very minute quantity dissolved in benzol gives a beautiful more or less blue-green fluorescence, with no special dark or bright bands. Half an ounce of the suspected beer should be evaporated to so small a bulk that it may occupy only about half an inch in the depth of a test-tube half an inch in diameter, and an equal amount of benzol added to it, with about an equal quantity of alcohol; since, without this last, the globules of benzol collect together with extreme slowness. After well agitating the whole, the tube should be set aside until the benzol has collected at the top, as a clear solution, which must then be introduced into one of the cells just described, by means of a pipette. In the case of pure beer, this solution is of a faint yellow colour, but is scarcely at all fluorescent. If no more than one grain of turmeric has been added to a gallon of beer, the fluorescence is so strong that it could not be seen to greater advantage, and even as little as one-tenth of a grain per gallon may be detected with confidence.

It will thus be seen that the spectrum method of study serves to throw considerable light on some of the changes that take place in the process of brewing, and would also enable us to detect the presence of some adulterations; but, at the same time, it would always be requisite to bear in mind that it is possible that some of the colouring matters I have described may themselves become altered when kept in solution for a considerable time.

Adulteration in Drugs, &c.—Mustard.

I now proceed to describe the detection of adulteration in a variety of substances. Having just explained the method to be employed when the presence of turmeric is suspected, it may perhaps be well to mention now all that need be said on that substance. Its presence may easily be detected in nearly all the ground mustard sold in the shops; and, as far as I am able to judge from the intensity

of the fluorescence, the amount varies from about one-third to one-half per cent.

The natural seeds contain a yellow colour soluble in water, which is the same as that found in many yellow leaves; another yellow colour, insoluble in water, but soluble in alcohol, which corresponds with the xanthophyll of yellow leaves; and there is also often present a small quantity of chlorophyll in the imperfectly ripe seeds. The powdered mustard should be digested in alcohol, about an equal quantity of water added, and the solution filtered. On agitating with benzol this rises to the top, with the colour of the turmeric in solution, which can be easily detected by its strong green fluorescence. Chlorophyll, if present, would give a red fluorescence, and by transmitted light, a spectrum with well-marked absorption bands.

Rhubarb.

The same process may be successfully employed in the case of rhubarb; and as small a quantity of tumeric as 1-10th per cent may be detected in no more than 2½ grains of rhubarb. There is not the least difficulty in distinguishing, by this means, inferior pale rhubarbs coloured by turmeric, so as to resemble those of the best quality.

The detection of small quantities of gamboge, added to increase the purgative action of these inferior kinds, is not so easy, and requires some care, especially in the presence of turmeric. The suspected powder should be placed on a small filter, and so little alcohol added as will give a few drops of clear solution, which would contain a comparatively large amount of the very soluble gamboge, and but little of the less soluble colour of the rhubarb itself. This alcoholic solution should then be agitated with bisulphide of carbon, and the supernatant alcoholic solution removed by means of a pipette and blotting-paper, and the solution in the bisulphide evaporated to dryness. This would contain a colour peculiar to the different kinds of rhubarb, and, perhaps, also turmeric and gamboge. If a small quantity dissolved in benzol gives the green fluorescent solution, turmeric is present; and, in order to detect the gamboge, it would then be requisite to re-dissolve in alcohol and add a little nitric acid, which so changes the colour of the turmeric that it is no longer removed by agitating with bisulphide of carbon; whilst the gamboge remains unchanged, and is abstracted by it from the alcoholic solution. After separating this, evaporating the bisulphide to dryness, and re-dissolving in alcohol, a small quantity of an alcoholic solution of iodine should be added, and then excess of ammonia, a little sulphite of soda, and a drop of water, to make it dissolve. This ensures the complete removal of any free iodine that may remain after the addition of ammonia.

In the case of pure rhubarb, this solution, when sufficiently but not too strong, has a decided pink colour, giving no well-marked absorption band in any part of the spectrum, but transmitting the blue rays very considerably better than the green; whereas, when gamboge is present to the extent of 2 per cent or upwards, the yellow colour due to it cuts off the blue light, and the solution is orange colour. The spectra are as follows:—

Pure rhubarb..	4	...	8	9 .. 10 —	— 11 —
Rhubarb, with 2 per cent of gamboge	4	...	9	— — 10 —	
" " 4 "	4	...	8	— — 9 —	
Gamboge alone	7	..	8	— — 9 —	

In very many other cases, bisulphide of carbon is a most valuable reagent to separate different colours. An excess should be agitated with the alcoholic solution, when it sinks to the bottom, carrying with it the whole of some colours, and leaving the alcohol quite colourless. Other colours are only partially removed; whilst others are not abstracted in the least degree. These last are usually, but not always, those soluble in water; whereas, those easily removed are usnally, if not always, insoluble in the liquid.

The cells for the examination of the spectra of solutions in bisulphide of carbon, ether, chloroform, or benzol, should be fixed to the glass plate by means of a mixture of glue and honey, made so as to be quite stiff, but yet to melt when warmed. Cells so cemented must be washed out with the liquids named above, and never with water or hydrous alcohol. The spectra of colours dissolved in the bisulphide are far more characteristic than when dissolved in any other liquid. So far, I have met with between two and three dozen different vegetable colours soluble in this reagent. The absorption bands are much farther removed from the blue end, when they occur in that part, so as to be far more distinct; and their position is not subject to variation from any change produced by evaporation, as in the case of ordinary alcohol, which may thus become more weak, and give the bands in a very different situation.

On the whole, the spectra are so characteristic and uniform that different colours, soluble in bisulphide of carbon, may usually be recognised in a very satisfactory manner by means of the spectrum of that solution alone; and this is fortunate, since such colours can seldom be distinguished by their behaviour with reagents. The dried colour must be dissolved in fresh bisulphide, since, when it separates from the alcohol, it contains some of that liquid in solution, which alters the position of the bands. As an illustration of what may be done, I give a few examples:—

Cheese.

Cheese of orange colour was digested in bisulphide of carbon, the solution washed by agitating with alcohol, and evaporated to dryness. On re-dissolving in alcohol diluted with a little water, a considerable amount of oily matter was separated; and, after evaporating the clear solution to dryness, and re-dissolving in bisulphide of carbon, it gave the spectrum $\frac{5\frac{1}{2}}{\cdot\cdot}$ $\frac{7\frac{1}{2}}{\cdot\cdot}$, which corresponds exactly with that of red annatto.

In all such experiments, it is requisite to use deep experiment cells (I use one 2½ inches deep), so that the amount of the bisulphide may be large in comparison with that of the oils, since the presence of much oil causes the bands to lie nearer the blue end, and thus interferes with the production of the characteristic spectrum.

Butter.

Treating yellow butter in a somewhat similar manner, I obtained the spectrum $\frac{6}{\cdot\cdot}$ $\frac{7\frac{1}{2}}{\cdot\cdot}$. This differs entirely from that in the case of cheese, and corresponds with the spectrum of the colour of the exterior orange portion of carrots; but I am not quite certain whether this might not be derived from carrots eaten by the cows, though I am more strongly inclined to believe that it had been artificially introduced to increase the colour of the butter.

The difference between the spectra of the above-named colours and of various others closely allied to them will be better understood from the following table. In all cases they are those of the solutions in pure bisulphide of carbon:—

Red annatto	$\frac{5\frac{1}{2}}{\cdot\cdot}$	$\frac{7\frac{1}{2}}{\cdot\cdot}$	
Exterior of carrot and the skins of several kinds of fruit	$\frac{6}{\cdot\cdot}$	$\frac{7\frac{1}{2}}{\cdot\cdot}$	
Xanthophyll of many yellow leaves and flowers, and of the interior of carrots ..	$\frac{6\frac{1}{2}}{\cdot\cdot}$	$\frac{8}{\cdot\cdot}$	
Colour of the petals of *Brassica* and of many other yellow flowers	$\frac{6\frac{3}{4}}{\cdot\cdot}$	$\frac{8\frac{3}{4}}{\cdot\cdot}$	
Orange-yellow colour of turnip roots, and of the flowers of *Eryssimum Perofskianum* ..	$\frac{5\frac{1}{2}}{\cdot\cdot}$	$\frac{6\frac{3}{4}}{\cdot\cdot}$	$8\frac{3}{4}$

It will thus be seen that these spectra differ from one another so much as clearly to show that they are due to different substances, which are often further distinguished by their different behaviour with bisulphide of carbon and alcohol, some being almost entirely, and others only very partially removed from the alcoholic solution by that reagent, so that they may be separated when two occur

mixed, as is not uncommon in some leaves and flowers. By first agitating the alcoholic solution with a little bisulphide, and washing this with alcohol, one may be procured nearly pure; and then, after agitating with a second small quantity of bisulphide and removing it, the other colour may be obtained nearly pure by evaporating the alcoholic solution to dryness, and dissolving the residue in bisulphide, which leaves indissoluble any of those numerous colours soluble in water which so commonly occur in leaves, flowers, and fruits. It is now nearly two years since I determined the existence of a considerable number of distinct substances, of which at least eight have lately been described by Dr. Thudichum.* under the general name of *leuteine*. I think that this new name can only be looked upon as something like the old term *xanthophyll*, as hitherto inaccurately employed for a whole series of yellow colours, some of which correspond with some of those included under *leuteine*. If it were thought desirable to have a generic name, the term *leuteine* might indeed be employed; but I must protest against the idea that the substances described as such by Dr. Thudichum are one single colouring matter. Some of their properties are indeed very similar, but that is often the case with those substances which give closely connected spectra, even when other facts show that they are entirely distinct, for there seems to be a sort of correlation between optical characters and chemical reactions; but this is no reason why we should confound together substances giving absorption-bands in distinctly different positions in similar solutions.

Saffron.

The adulteration of saffron with the sliced petals of the yellow crocus could easily be detected, even in a solution, by means of the remarkable spectrum of the latter, when the product of the action of bromine is deoxidised by sulphite or hyposulphite of soda. To the alcoholic solution of the colours soluble in water an aqueous solution of bromine should be added very gradually, until, after having become quite pale, it is made slightly yellow by the addition of more. Excess of ammonia and a little sulphite of soda should then be added. In the case of pure saffron the liquid remains almost or quite colourless, whereas ammonia first turns the colouring matter of the crocus to a red, which soon becomes yellow, and then sulphite of soda changes it to a remarkably fine red, which is highly fluorescent or red-orange colour, the spectrum showing a bright narrow band at about 3½. That of the transmitted light is very characteristic, and shows an excellent absorption band at 4½. On adding citric acid the colour becomes red-pink; it is still highly fluorescent, but of more yellow tint than before, the bright band being raised to about 4, and the absorption band in the spectrum of the transmitted light is raised to 5½: but the addition of hydrochloric acid destroys both the fluorescence and the absorption band. The only colour that I have met with analogous to this is one which occurs in the yellow flowers of several plants allied to the common wallflower (*Cheiranthus Cheiri*), but the bands are in distinctly different positions. The production of the fluorescent colour is apparently due in both cases to deoxidisation, for even proto-sulphate of iron has the same effect as sulphite or hyposulphite of soda. If too much bromine be added, this change does not take place; but by a little care a small amount of the petals of the yellow crocus could be detected in a considerable quantity of saffron. The presence of safflower might be recognised by a similar process, but not so decidedly. After adding bromine and ammonia, it remains distinctly yellow, but gives no absorption band, whereas pure saffron is thereby quite decolourised.

Aloes.

I have tried a number of experiments in order to ascertain whether it would be possible to detect the adulteration of the socotrine aloes with the hæpatic, but have not yet succeeded in discovering any satisfactory method. It appears as if both contain the same general colouring matter, but the socotrine a second in addition. When ammonia is added to the alcoholic solutions, the socotrine gives a more orange colour than the hæpatic, and the green part of the spectrum is more absorbed; so that, when compared side by side, the spectra are—

Socotrine	..	..	..	..	4 ..	6½ — —
Hæpatic	..	..	..	..		6¾ — —

It would, therefore, be possible to distinguish them from one another, or to detect the socotrine in the hæpatic, which is, however, the reverse of what would be likely to occur, since inferior things are not often adulterated with better.

Adulterations by means of Cochineal and Magenta.

Cochineal may be best detected in the tincture of roses by adding to the aqueous solution bicarbonate of ammonia and sulphite of soda. This changes the colour of the pure tincture to a very pale yellow, but that adulterated with cochineal to a light red. The spectra are somewhat thus:—

Pure tincture	..	..	..	8 ..	9 — —	10—
Adulterated with cochineal				3½ ..	7 — —	9—

The presence of magenta might be recognised by the spectrum of the solution in its natural state. The pure tincture shows no narrow absorption band in the green, whereas magenta gives a very distinct one, situated at 5 of my scale. In the case of the syrup of damsons and similar fruits, magenta may be detected, when in very small quantity, by agitating a dilute alcoholic solution with chloroform. If so much alcohol be added as only to partially dissolve the chloroform, scarcely a trace of the magenta is left in the alcoholic solution; and the characteristic spectrum can be easily seen by examining the chloroform, which scarcely abstracts any other colour. Ammonia produces no change in a solution of magenta in dilute alcohol; but the absorption band is immediately removed by a mere trace of sulphite of soda.

It would scarcely be a correct description of the facts to say that cochineal may easily be *detected* in pink-coloured confectionery, since, in some cases, its spectrum is seen to almost as great advantage as in any condition without any preparation, and it could generally be recognised with very little manipulation.

No doubt many other applications of methods similar to those I have described would present themselves to any one engaged in technical inquiries. I do not for one moment pretend to have exhausted the subject. I have merely examined various questions in order ascertain what methods might be employed with advantage; and I trust that the cases described above will, at all events, facilitate the application of this kind of qualitative analysis to practical questions; for I have met with many who were anxious to employ it, but had not sufficient time at command to make the preliminary experiments, which are so very necessary in all such inquiries.

Uses of Aluminate of Soda.—The white opaque glass (semi-porcelain) of which the French gas-globes are often made is manufactured in various ways. Hitherto, kryolite (fluoride of aluminium and sodium) has been found to answer best for the manufacture of the opaque white glass, but it seems now destined to be supplanted by aluminate of soda. In the application of the latter, no fluorine compounds are evolved which act very much on the substance of the melting pots. 1 cwt. aluminate of soda is equal to 1¾ cwts. kryolite and 1-10th cwt. calcined soda in the mixture for making that kind of glass. The aluminate, as manufactured by kryolite-soda makers, is quite free from iron, which is never the case with kryolite itself. Other applications of the new manufacture are in dyeing and print works; as a mordant in soap making, where white and heavy soap is required; in precipitating dyeing lakes, &c. Very likely the applications of this product will become more numerous as it becomes better known.

* *Proceedings of the Royal Society*, vol. xvii., p. 253, January, 1869.

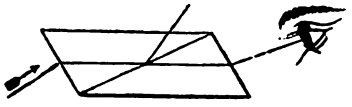
ON MICROSCOPICAL MANIPULATION.*

By W. T. SUFFOLK, F.R.M.S.

(Continued from p. 302.)

By an ingenious process, invented by Mr. Nicol, a crystal of Iceland spar is divided in the direction indicated in Fig. 35, and joined together again with

Fig. 35.†

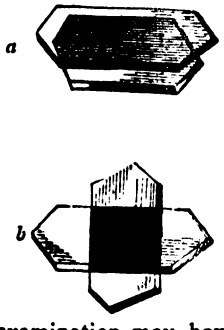


Canada balsam. This causes one of the rays to be so much refracted that it is thrown altogether out of view, and only one polarised ray is transmitted. This contrivance is known as the *single image* or *Nicol prism*, and is the means of polarisation most generally adopted for microscopical purposes.

Polarisation may also be effected by the use of thin slices of a mineral known as *tourmaline*. This crystal, when cut into thin plates parallel to the axis of the crystal, allows only the undulations in one plane to pass, the other being stopped. The cause of this action is, as yet, not understood. If two plates of tourmaline are superposed, and held before a strong light, it will be found that the light is alternately transmitted and stopped at every 90°, when one of the plates is rotated.

The same effect is produced, in a much greater degree, by using a pair of crystals of sulphate of iodo-quinine, more commonly known as *Herapathite*, from its discoverer, the late Dr. William Bird Herapath. This salt is prepared by a tedious and complicated process, and described in a communication by Dr. Herapath to the Royal Society, and quoted in many microscopical works ("Micrographic Dictionary," second edition, p. 590). The obtaining of large regular crystals fit for polariscopes is a matter of great difficulty; and, unless the student is very expert in chemical manipulation, he is recommended not to attempt it. Small specimens fit for

Fig. 36.



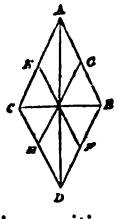
microscopical examination may, however, easily be made. This salt is the most powerful polarising agent known. If two crystals are superposed with their axes parallel (Fig. 36, *a*), light is readily transmitted; but, if the axes are crossed, as in *b*, the parts covering each other become perfectly opaque to transmitted light. This can easily be seen in a slide of the crystals mounted as a microscopical object, as some of the crystals are sure to be in this position.

The sky possesses the power of reflecting polarised light. If the observer stands with one shoulder directed to the sun, so that he faces a point 90° from it, and looks at a white cloud through a Nicol prism, he will find that the light reflected from the cloud is polarised, and that, as the prism is rotated, the cloud will alternately appear as a white cloud on a dark ground and a dark cloud on a light ground.

The effects here described may readily be seen without the special apparatus of mirrors, &c., by any one who has a microscope fitted with the usual polarising apparatus of two Nicol prisms. If the larger one, *the polariser* be put in its place below the stage, and the mirror so arranged that the light of a lamp or daylight be directed through it, it will be found, upon rotating the prism in its fitting, that no change is apparent, as the light, although polarised, is transmitted in every position of the prism. If the small prism, or *analyser*, be now put in its place, either over the object-glass or, better still, over the eye-piece, it will be found that the alternate transmissions and stoppages of light take place. If a film of *selenite* be now placed on the stage of the instrument, it will be found that the light will be coloured; and, when one of the prisms is rotated 90°, the colour will change to the complementary tint. For instance a film that transmits red light in one position of the prisms will transmit a green of such quality as to produce white light, were the two mixed. Blue would produce orange every quarter revolution; and so on through the other tints of the spectrum. Similar effects are produced by using films of mica, and all crystals possessing the property of double refraction.

To understand these changes of colour, it will be necessary to describe the direction of the axes of a crystal of selenite, which is represented in Fig. 37,

Fig. 37.*



A, D and C, B being the position of the depolarising axes, and E, F and C, H that of the optic axes. To understand the powers of these regions of the crystal, it will be necessary to try another experiment, which, although more advantageously shown with a large polariscope, can be done sufficiently well under the microscope. Let the film of selenite be so mounted as to be capable of rotation. If the stage of the microscope is capable of concentric rotation, no further contrivance is necessary. If the prisms now be arranged for the production of colour, and the selenite be slowly rotated, it will be observed that the colour gradually disappears. On continuing the rotation, it increases, and regains its intensity. If the amount of rotation is noticed, it will be found that the disappearances coincide with the position

* The substance of a course of lectures delivered to the members of the Quekett Microscopical Club, January—April, 1869.

† Pereira on "Polarised Light," published by Longmans and Co.

* Brooke's "Natural Philosophy," published by Churchill.

of the optic axes, E, F and G, H, and while the greatest intensity of colour is produced when the plane of polarisation passes through the depolarising axes, A, D and B, C. If the analyser be removed, no colours are to be seen; it is therefore evident that the analyser plays some important part in the production of these colours.

The selenite, being a doubly-refracting crystal, causes the ray of polarised light to be divided into two, which are, as usual, polarised in perpendicular planes, and, reaching the eye together, no colour is produced; but, if the analyser is added to the combination, the colourless image is broken up into two coloured ones, one only of which reaches the eye. If, instead of the Nicol prism, a contrivance known as the "double-image prism" be used, which will transmit both rays, but in a separate condition, the two images of complementary colours will be seen at once, and, if, by a suitable contrivance, they be made partially to overlap, the part where they join will be white, produced by the union of the two complementary tints.

The position of the optic axes may be easily observed in the corpuscles of starch and other polariscope objects which produce the well-known black cross, which indicates in a very marked manner the situation of these axes of no polarisation.

The apparatus employed for the examination of microscopical objects by means of polarised light consists of a *polariser*, *analyser*, and *retarding plate*.

The *polariser* is generally a Nicol prism, mounted so that it may be conveniently rotated; this is attached, by a suitable fitting, either beneath the stage, or, in large microscopes, to the sub-stage movement.

The *analyser* varies, being, according to circumstances, a Nicol prism, tourmaline, or Herapathite. The *Nicol prism* is the form of analyser generally used, and can be placed either over the eye-piece or within the body of the microscope above the object-glass; in the first position it has the advantages of being easily rotated, and of not interfering seriously with the definition of the magnified image; but, on the other hand, when used with any eye-pieces but those of the lowest power, it cuts off the margin of the field and reduces it to an injurious extent; this is owing to the prism by its thickness causing the removal of the eye to some distance from the eye-glass, although the Nicol prism, when intended for use as an analyser, is generally made as short as is consistent with efficient action. When the prism is placed within the body, it does not cut off any portion of the field, but the interposition of a dense substance, like Iceland spar, impairs the corrections and consequently the definition of the object-glass, and also causes some loss of light. It is much to be regretted that in many of the smaller microscopes no other provision is made for the placing of the analysing prism. When the binocular is used with polarised light, the analyser can be placed in no other position, and it is usually mounted in a short adapter so contrived that the prism can be easily rotated. It is well to have the means of using the analyser in both positions, that choice can be made of that best adapted to the kind of observation in progress; if very perfect definition is of less consequence than a field of full dimensions, as in viewing such objects as crystals, in which very little detail is to be seen, then the prism in the body may be employed with advantage; but should the formation of an image very perfect in its details be required, then the prism must be placed over the eye-piece.

Tourmaline, when it can be obtained of sufficiently pale colour, makes a good analyser, from its thinness it can be used over deep eye-pieces without cutting off the field; good stones are, however, scarce, and consequently expensive, as many light coloured specimens do not polarise well. The tourmaline is mounted in a brass cap similar to the one placed on the eye-piece, which is to be removed and the analyser substituted. Crystals of *Herapathite* polarise more powerfully, and are much lighter in colour than the palest specimens of tourmaline, and when they can be procured make very perfect analysers; they are extremely thin and do not interfere at all with definition, and are to be preferred in all delicate investigations. Where, however, total freedom from colour is a necessity, the Nicol prism, notwithstanding its other disadvantages, must be used.

The *retarding plate* or *selenite film* is commonly mounted, either on card, like an ordinary slide, or else in a brass plate, with a ledge to keep the object from slipping off; this is a very disadvantageous form, as the selenite cannot be rotated, while in a perfect polarising arrangement, every part, object included, should be capable of rotation. The most convenient and useful arrangement of selenites is that devised by the late Mr. Darker, in which a series of three discs are by combination made to give as many as thirteen different tints. In large microscopes having a substage, these selenites can be mounted so as to be capable of rotation either together or separately, and also allowing the selenites to be used or not, without disturbing the arrangement of the object on the stage.* These advantages have hitherto been confined to large microscopes; but Mr. Baily has so mounted a set of Darker's selenites for the author that they can be placed upon the stage in the ordinary manner, and at the same time allow of discs being added or withdrawn and rotated, without interfering with the object; the thickness of this stage plate is no more than is necessary to contain the three discs and allow them space to move, and all complicated machinery is dispensed with. The arrangement of Darker's system of selenites appears, at first sight, somewhat complicated, but is not so in reality, and the power of obtaining such a variety of coloured backgrounds is a very great advantage. The series consists of three discs, marked $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, which figures represent a certain amount of retarding influence upon the wave of polarised light and consequent colour production. Besides the figures just mentioned, each disc has engraved upon its mounting the mark P.A., meaning positive axis; when the selenites are superposed with these marks coincident, the effect is, that the power of one selenite is added to that of the other; for example, if the $\frac{1}{4}$, and $\frac{1}{2}$ discs are so placed, the power will correspond to the sum of the numbers, viz, $\frac{3}{4}$, but if the $\frac{1}{2}$ be turned round 90° then the $\frac{1}{2}$ will have only a power of $\frac{1}{2}$, the crossed position of the $\frac{1}{4}$ subtracting instead of adding its power to the $\frac{1}{2}$. The experiments with selenite films already described will have prepared the student to understand the cause of this; it will be recollected that the colour disappeared when the selenite passed through one of the optic axes

* A very perfect polarising apparatus is described by Mr. J. J. Field, *Journal of the Quekett Microscopical Club*, vol., p. 215; also in *Monthly Microscopical Journal*, vol. ii., p. 276.

of the selenite, provided the position of the prisms remained the same. If, instead of moving the disc 90° it be only moved 45°, the effect will be to neutralise; instead of giving a negative power the result will be the same as if the selenite were withdrawn. The following table, of the arrangement of Darker's selenites may be useful to those who possess the series. The colours vary somewhat in different sets, so the table must be made out by each observer for his own use. The colours in the following table are those given by Richard Beck in his work on "The Microscope:"—

	Prisms at right angles.	Complementary tint.
1. ¼ by itself ..	Very light lavender.	Straw colour.
2. ¾ − ¼	Darker do.	Light yellow.
3. ½ by itself ..	Deep blue.	Light maize.
4. ¾ + ¼	Very light blue.	Orange.
5. ¾ − ½ − ¼ ..	Lake.	Emerald green.
6. ¾ − ½	Deep blue.	Bright yellow.
7. ¾ − ½ + ¼ ..	Light green.	Light purple.
8. ½ − ¼	Light plum colour.	Pea green.
9. ½ by itself ..	Blue green.	Salmon.
10. ¼ + ¼	Green yellow.	Mauve.
11. ¾ + ½ − ¼ ..	Pink light.	Green.
12. ½ + ½	Light pink.	Deep green.
13. ¾ + ½ + ¼ ..	Very light red.	Stone green.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 14, 1869.

J. P. JOULE, LL.D., F.R.S., &c., President, in the Chair.

SIR Charles Lyell, Bart., LL.D., D.C.L., F.R.S., &c., and Henry Clifton Sorby, F.R.S., F.G.S., were elected Honorary Members of the Society. Mr. Robert Routledge was elected an Ordinary Member.

Mr. WILLIAM BOYD DAWKINS, F.R.S., exhibited some old mining tools, brought over by Mr. Bauerman from the turquoise mines of the promontory of Sinai, consisting of a stone-hammer and rude splinters of flint. The turquoises occur in a bed of a quartzose mottled sandstone, in Wady Sidreh and Wady Maghara, in joints running, for the most part, north and south. They were worked, according to the evidence of the hieroglyphic inscriptions on the rock, by the Egyptians from the third to the thirteenth of the dynasties mentioned by Manetho. In and around the workings there are still the tools with which they were carried on. Innumerable splinters of flint, with their points blunted and rounded by use; stone-hammers, some of which are broken; and rounded pebbles, with a concavity on either side, caused by the friction of the thumb and finger, charged with particles of sand; and segments of small wooden cylinders, lie together. The flint flakes exactly coincide with the grooves in the rock made in the excavation, and evidently have been blunted by such use. The fragments of wooden cylinders are believed by Mr. Bauerman to have been portions of the sockets into which the flakes were fitted. The round pebbles were probably used for driving the rude chisel formed by the flint inserted into the wooden socket; while the large stone-hammers were used for breaking up the rock. There was no evidence that metal of any kind was used in the work. Mr. Bauerman also satisfied himself that the hieroglyphs were cut with implements similar to those used in the mining. This discovery is very important, because it opens up the question as to what tools the Egyptians used in working their wonderful monuments of granite and syenite. If it were worth their while to conduct turquoise mining with flint flakes in the Sinaiitic promontory, and if they used the same tools in the hieroglyphs that fix the date of these mines (and of this there can be no reasonable doubt), it is very probable that they employed the same means for the same end elsewhere, and that, to say the least, a part of their marvellously minute sculpture in Egypt has also been wrought with flint. There is no evidence that they were acquainted with the use of steel. Iron and bronze are not hard enough for the purpose. The minute and delicate sculpture left behind by the Mexicans, which can be proved to have been worked with stone tools, adds to the probability of this view.

NOTICES OF BOOKS.

A Pharmacopœia, Including the Outlines of Materia Medica and Therapeutics, for the Use of Practitioners and Students of Veterinary Medicine. By RICHARD V. TUSON, F.C.S., Professor of Chemistry and Materia Medica at the Royal Veterinary College. London: John Churchill and Sons. 1869. Pp. 311.

THE preface informs us that this work is designed for the use of practitioners and students of veterinary medicine. The agents are arranged in alphabetical order, according to the plan adopted in the "British Pharmacopœia," and are treated of under the following heads:—(1) Latin Pharmaceutical Name; (2) English Pharmaceutical Name; (3) Synonyms; (4) Compositions; (5) Mode of Preparation; (6) Characters and Tests; (7) Actions and Uses; (8) Doses; (9) Modes of Application; (10) Incompatibles; (11) Antidotes; (12) Preparations. This work bears evidence of the progress of scientific veterinary medicine in this country, which has hitherto in this respect remained backward as compared with France, Belgium, and Germany, and last, but not least, with the Netherlands, where scientific veterinary medicine has replaced rude and clumsy empiricism and quackery since the middle of last century. Veterinary medicine requires in its practitioners an amount of tact and spirit of patient observation, which in some respects makes it as difficult a practice as that of the diseases of infants and young children. The book of Professor Tuson is carefully written, and is a valuable addition to the literature of the subject. It will be valued not only in this country, but in many parts of Europe, as well as in that great portion of America where the English language is widely used and known. The composition of bodies is expressed in modern atomic weights, a table of which, together with a list of the old ones, is appended. At page 24 we meet with Aër Chlori; it would have been better to write chlorium gasiforme, or gas chlorium. Aër is strictly limited to the atmospheric air we breathe, and if it is desired to express the state of aggregation of chlorine at all, it is best, we think, to use the word *gas*, first introduced by the well known Van Helmont; instead of *aërial* we should prefer gaseous. We notice with pleasure the excellent tables of weights and measures of the metrical system, and the relation of these weights to the British and *vice versâ*. The index to veterinary medicines, *arranged according to their actions and uses*, has been very carefully compiled, and it is a very useful feature therein that the Greek and Latin words have been properly explained and their derivation made clear. The work is well executed, being printed in a very clear and legible type, and has been carefully revised, since we have not, on perusing it, met with any clerical errors. We recommend the book with pleasure, and hope that veterinary medicine may rise, as it ought, in the estimation of scientific, and especially medical men, who should consider that the veterinary physician may exercise, by the proper attend-

ance to his calling, a great influence for the general public good. Seeing that that portion of *Police Science*, as Dr. H. von Mohl calls it, which is termed "Administration de la Sûreté et Salubrité Publique," is in this country an ill-defined and rudely digested chaotic mass, one cannot wonder that sufficient care has not been taken to assign to veterinary medicine its proper place and the social status it really deserves.

A Treatise on Asiatic Cholera. By C. MACNAMARA, Surgeon to the Calcutta Ophthalmic Hospital. London: John Churchill and Sons. 1870.

As may be expected from a medical man resident in the endemic area of cholera, this work contains very valuable information on a most difficult subject. From Section II., "On the Historical Account of Cholera," we learn what the Sanskrit writers have recorded on this subject; the translation given of an *historia morbi* by Susruta is highly interesting, and the more so to those who ever have witnessed patients attacked by Asiatic cholera, since they can hardly fail to observe the great resemblance this description bears to the reality; and from the vestige of a remote antiquity it would also appear that the disease has been in existence sporadically long before our era. The earliest notice of the existence of cholera in Hindostan, from the pen of a European, occurs in the "Lendas da India," by Gaspar Correa, in the year 1503; the entire chapter on the history of this disease is in every way interesting, and contains a great deal of hitherto unknown, or, at least, not well collected information. The section on the geographical distribution of cholera, and that on the bearing of meteorological influences upon the spread of this disease is also very valuable; the etiology of cholera is lucidly treated of, and the theories of Messrs. Bayer, Pettenkofer, Farr, and others, discussed in a clear manner. The value of the work is enhanced by the addition of several official reports, well executed maps, and statistical diagrams. As is usual with these publishers, this work is brought out in excellent style, and is a most valuable addition to the bibliography on this subject.

LABORATORY NOTES.

SULPHURETTED HYDROGEN APPARATUS.

THE following apparatus for the production of sulphuretted hydrogen, will perhaps be found useful.

It consists of a wide-mouthed bottle, A, fitted with a sound cork having two holes; through one hole a short glass tube (similar to the tube through which air is blown in a common wash-bottle) is passed, projecting into the bottle about ¼ inch.

A second smaller bottle, B,—one that can be lowered into A—is also fitted with a cork having two holes; through one a U-shaped tube is passed in such a manner that one end may touch the lower surface of the bottle A, and the other that of B, when one bottle is within the other. That portion of the tube which touches the lower surface of the big bottle should be of india-rubber, to prevent breakage.

The small bottle, with its cork and tube, should now be lowered into the bottle A, and through the remaining hole in each cork a tube is to be passed which shall project into the bottle B, about ¼ inch. All the holes through which the tubes pass should be lined with india-rubber tubing to render them air-tight.

To use the apparatus, remove the large cork, and it will necessarily bring away with it the small bottle with its tubes. Fill the bottle B, about three-fourths with acid sulph. dil.; fix its cork. Now place in the bottle A some sulphide of iron in lumps. Lower the small bottle till it rests on the bottom of A. Fix in the large cork. If air be now blown through the tube projecting into the bottle which contains the acid, the contents will be forced through the U-shaped tube into the bottle A, where it will mix with the sulphide of iron, and the gas will be evolved, which will escape through the tube opening into A. When sufficient gas has been obtained, by blowing through the tube by which the gas is escaping, the acid will again be forced through the U-shaped tube into A, and all action will cease. Powdered sulphide of iron must not be employed, because it would be carried back with the acid into the small bottle, where the action would be continued.

C. J. H. WARDEN.

Dec. 20th, 1869.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Under this heading will be found an encyclopædic list of chemical papers published abroad during the past week, with abstracts of all susceptible of advantageous abridgment. The two half-yearly volumes of the CHEMICAL NEWS, *with their copious indices, will, therefore, be equivalent to an English edition of the "Jahresberichte."*

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus des Séances de l'Académie des Sciences, December 20, 1869.

This number contains the following papers and memoirs relating to chemistry or sciences allied thereto:—

Distribution of Potassa and Soda in Plants.—M. Peligot.—This is a third paper on this subject, and the author treats in it the question whether plants have the faculty of absorbing the alkaline substances contained in the soil, and also whether they can, by any choice, assimilate the salts of potassa in preference to those of soda. The main points of this paper are:—(1) That soda is met with in plants in several distinct forms; this alkali is taken up by the radicles, penetrates into the tissues of the plants, and is found among the mineral matter left after incineration of the same. (2) In some marine plants, soda exists in the form of salt water, in the sap which fills the tissues of these succulent vegetables. (3) All plants grown sufficiently near the sea-board contain chloride of sodium dispersed over their surface; but the presence of this salt in the ash of such plants does not imply that this salt has contributed to the development of the plants. The discussion of this paper gives rise to a statement of facts observed last autumn by M. Elie de Beaumont, who says that, while staying at Canon, Department du Calvados, and at a distance of 23 kilometres (about 14·3 English miles) from the coast, he observed that, during a severe W.S.W. gale, the leaves of the trees of that part of the country were, so to say, burnt up; and he ascribes this to the pulverised sea-water dust carried inland by this gale, proving that at a great distance from the coast sea-salt may be mechanically brought over.

Observations on the Communication of M. Soret, bearing upon the Illumination of Transparent Substances.—M. Lallemand.

Formation and Duration of Induced Currents.—M. Blaserna.—Both physico-mathematical papers.

Electro-Motor Force Developed by Platinum when it is brought into Contact with Various Liquids.—M. Gaugain.—The contents of this paper may be resumed as follows:—(1) That unplatinised platinum which is left for some time in an acid liquid is gradually modified, and thus becomes, after a shorter or longer lapse of time, more positive than it was at the moment of its first immersion. (2) That platinised or unplatinised platinum which is placed in an alkaline fluid becomes gradually more negative.

Researches on the Preparation and Purification of Sulphide of Carbon.—M. Sidot.—The chief results of the experiments made on this subject by the author prove that a full red heat is the best temperature for obtaining the largest quantity of sulphide of carbon from a given weight of sulphur in the state of vapour and charcoal. At a low red heat (*rouge sombre*), as well as at a bright red heat (*rouge vif*), the formation of this sulphide takes place, but the quantity obtained is by far smaller. As regards the purification, the author first re-distils the raw product, then shakes the distillate up with mercury, until the latter becomes black, and this operation is so long repeated as the metal is affected by the fluid, or, rather, by any sulphur dissolved in it. Sulphide of carbon thus purified is freed from the fœtid odour it generally has, and exhibits a smell of ether.

Composition of the Skin, the Modifications it undergoes by Tanning, and the Fermentation of Tannin in the Tan-Pits.—M. Müntz.—The author has investigated the skins and hides during the three principal stages of the operation of tanning it. In fresh

state, skin contains from two-thirds to three-fourths of its weight of water; dried at 110°, it becomes one of the most hygroscopical substances we are acquainted with. The immediate analysis of skin led to the following results for 100 parts:—Cellular tissue not acted upon by boiling water, 3·080; fatty matter, 1·058; mineral matter, 0·467; substances capable of forming gelatine, 95·395. During the tanning, the substance fixed in and upon the skin is not tannin, but a derivative thereof, which may be denominated tanning material (*matiere tannante*), which differs from tannin in this respect—that it contains less oxygen and more hydrogen. The fermentation going on in the tan-pits takes place with exclusion of air, and gives rise to the formation of lactic, acetic, gallic, formic, and carbonic acids, while a small quantity of propionic acid is also formed.

An Error Committed in Saccharimetrical Estimations.—M. Maumené.—We intend to give a full translation of this paper at a future period.

Annalen der Chemie und Pharmacie, November, 1869.

This number contains the following original papers and memoirs:—

Balsam of Peru.—M. Kraut.—Among the substances originally only known and used in pharmacy, very few have given rise to such a number and such protracted investigations as the balsam just alluded to. The author of this paper has tried to reconcile, and bring into proper harmony, the researches of all his predecessors, and states that the oil of balsam of Peru (the cinnameine of Frémy) has been prepared by him by acting upon the original balsam with a mixture of ether and soda-lye containing about 4 per cent of soda. The ethereal solution is first washed, next deprived of the ether by distillation, and then the oil dried at 120° in a current of pure and dry hydrogen. By fractional distillation, this oil may be separated into three different portions:—(*a*) boils at 200°, and yields, on analysis, C_9H_8O; is converted into benzoic acid, without any evolution of carbonic acid, by the action of chromic acid. (*b*) boils at 300°, contains 79·09 per cent C and 6·0 per cent H, and was found to be benzoate of benzyl ether, a colourless fluid of the consistency of sweet oil of almonds; sp. gr. at 18·5°, 1·1114; formula, $C_7H_7.O.C_7H_5O$. (*c*) boils at the boiling-point of mercury; sp. gr. at 23°, 1·050; this substance is cinnamate of benzyl ether—formula, $C_7H_7.O.C_9H_7O$; the dark-coloured residue remaining in the retort is styracine. When the oil, as originally obtained, is submitted to the action of caustic potassa dissolved in alcohol, and the resulting substances examined, the author found:—(*a*) Cinnamate of ethyl ether, $C_9H_8.O.C_9H_7O$; (*b*) benzyl alcohol, boiling at 206·2; sp. gr. at 19°, 1·0465; not solidified at −18°; formula, $C_7H_7.O.H$. The chief constituents of balsam of Peru are—Free cinnamic acid, resin, and the benzyl ethers of benzoic and cinnamic acid.

Action of Sulphurous Acid upon Chloride of Platinum.—M. Birnbaum.—When platino-chloride of ammonium is mixed with an aqueous and concentrated solution of sulphurous acid, care being taken to keep the latter in excess, a yellow solution is obtained which, on being concentrated by evaporation on a water-bath just to the point of crystallisation, and then further dried over sulphuric acid, after addition of some sulphurous acid solution, yields a salt—

$$Pt\left\{\begin{matrix}Cl\\HSO_3\end{matrix}\right\}+2NH_4Cl.$$

This compound is to be considered as a monobasic acid, a view fully confirmed by the fact that, instead of the two molecules of chloride of ammonium, chloride of potassium, or sulphate of ammonium can be taken up. The potassium salt is—

$$Pt\left\{\begin{matrix}Cl\\KSO_3\end{matrix}\right\}+2NH_4Cl.$$

When ammonio-chloride of platinum is treated with acid sulphite of ammonium, a salt is obtained—

$$Pt\left\{\begin{matrix}HSO_3\\HSO_3\end{matrix}\right\}+2NH_4Cl+H_2O.$$

Octyl Compounds.—M. Schorlemmer.

Derivatives of Propan.—M. Schorlemmer.

Action of Bromine upon Ether.—MM. Ladenburg and Wichelhaus.—The action of bromine upon compounds of organic origin is either a substitution or an addition, so that the halogen is found instead of H, or has become incorporated with the organic molecule, which is thereby saturated; but this action is not that commonly met with when bromine acts on the substances known as "ethers," since very frequently the halogen in these instances combines with the radical (*e.g.*, C_2H_5), and, while displacing O, causes an intrinsic change of the molecule. The authors have investigated this action more especially with Kay's ether (orthoformic ether), boiling between 146° and 148°; bromine acts upon this fluid, even at the ordinary temperature, forming bromide of ethyl and carbonic ether. The reaction of the halogen upon this orthoformic ether is represented by the following formula:—

$$2CH(OC_2H_5)_3+Br_2=$$
$$=2BrC_2H_5+CO(OC_2H_5)_2+CHO(OC_2H_5)+C_2H_6O.$$

The authors also investigated the action of bromine upon orthocarbonic, ethyl-glycolic, and ethyl-lactic ether.

Contribution to Our Knowledge of Selenium.—M. Rathke.—This monograph is divided into the following sections:—The allotropic modifications of selenium, and their relation to those of sulphur; sulpho selenium; seleno carbon; selenium-xanthogenic acid; experiments made for the purpose of forming selenium-tetrethyl and sulphotetrethyl; ethyl-selenious acid.

Preparation of Zinc Ethyl.—M. Rathke.—The preparation of zinc ethyl, according to the method suggested by MM. Beilstein and Alexeyeff, is rendered of far easier execution when there is added to the mixture of iodide of ethyl and zinc (with or without the addition of sodium amalgam) a small proportion of zinc ethyl from a former operation. The author states that the formation of zinc ethyl is thereby accelerated to such an extent as to admit of the entire operation being finished, by the aid of the heat of a water-bath, in half an hour. When 2 grms. of zinc ethyl are added to 100 grms. of iodide of ethyl, the action becomes sometimes so violent as to necessitate the withdrawal of the source of heat and cooling of the retort wherein that action takes place.

Di- and Tri-Chlorobenzoic Acid.—MM. Beilstein and Kuhlberg.—Tenth portion of a memoir on the subject of "Isomerism of the Benzoic Group." This portion of the monograph is divided into the following chapters:—Dichlorobenzoic acid from dichlorotoluol; dichlorobenzoic acid from benzoic acid; trichlorobenzoic acid from trichlorotoluol; alcohol of trichlorobenzoic acid, $C_6H_2Cl_3.CH_2HO$; trichlorobenzoic acid from benzoic acid.

Action of $SbCl_5$ upon Chloride of Toluol.—MM. Beilstein and Kuhlberg.—The authors, referring to a treatise they published in vol. CL. of this periodical (title not given), now state that when chlorine is passed into boiling tetra-chlorotoluol chloride, $C_6HCl_4.CH_2Cl$ (boiling-point, 296°), they obtained, by the fractional distillation of the products of this reaction, a fluid boiling at about 285°, from which, at 84°, crystals were deposited, which proved to be pentachlorobenzol, $C_7H_2Cl_5$. When trichlorotoluol is acted upon by chlorine at its boiling-point, the authors obtained therefrom a substance (tetrachlorobenzol) boiling at 240°, fusing at 140°; formula, $C_7H_3Cl_4$.

Toluchinones.—M. Borgmann.—Trichlorotoluchinon, $C_7H_3Cl_3O_2$, a solid substance exhibiting yellow-coloured crystals; difficultly soluble in cold, but more readily in boiling, alcohol; very readily soluble in ether and chloroform; and readily decomposed by heat. Trichlorotoluhydrochinon, $C_7H_5Cl_3O_2$.—Needle-shaped crystals, readily soluble in alcohol, and fusing at 212°. Biacetyltrichlorotoluhydrochinon—

$$C_6Cl_3\left\{\begin{matrix}CH_3\\O.C_2H_3O\\O.C_2H_3O\end{matrix}\right.$$

a crystalline solid, readily soluble in alcohol and ether, and fusing at 114°. Biethyltrichlorotoluhydrochinon—

$$C_6Cl_3\left\{\begin{matrix}CH_3\\O.C_2H_5\\O.C_2H_5\end{matrix}\right.$$

also a solid substance, fusing at 107°. Monochlorotoluhydrochinonbisulpho acid—

$$C_6Cl\left\{\begin{matrix}CH_3\\OH\\OH\\(SO_3H)_2\end{matrix}\right.$$

a salt soluble in hot water, insoluble in alcohol, and crystallising in leafy-shaped crystals.

Supplementband, vol. vii., No. 1.

This number contains the following original papers and memoirs:—

On Mellitic Acid.—M. Baeyer.—From this very lengthy essay, we quote that mellitic acid was discovered by M. Klaproth, in a mineral called honeystone. The author refers, at some length to the researches made by MM. Wöhler, Liebig, Erdmann, Gerhardt, and others on this subject, and then states that, according to his own investigation, the most simple formula for mellitic acid is $C_{12}O_{12}H_6$; that is to say, that this acid is a benzol all the H of which has been replaced by the carboxyl group, CO.OH. This is fully proved by the fact that, when mellitic acid is decomposed in contact with soda-lime or lime at a high temperature, benzol and carbonic acid (carbonate of lime) are formed. This treatise is divided into the following sections:—Mellitic acid, which the author says is a sexbasic acid and a rare substance, since the mineral from which it is obtained is very sparingly found. Hydromellitic acid, $C_{12}O_{12}H_{12}$, also a sexbasic acid, obtained from mellitic acid by the action of sodium amalgam. Action of sulphuric acid upon hydromellitic acid, assisted by heat; the products of this action are carbonic acid, a quadribasic, and a tribasic aromatic acid—viz., isopyromellitic acid, $C_6H_2(CO_2H)_4$; and trimesinic acid, $C_6H_3(CO_2H)_3$. Hydroisopyromellitic acid, $C_{10}O_8H_{10}$. Hemimellitic acid, $C_9O_6H_4$. Pyromellitic acid, $C_{10}H_2O_8$. Hydropyromellitic acid, $C_{10}H_{10}O_8$. Action of sulphuric acid and heat upon hydropyromellitic acid. Trimellitic acid, $C_9H_6O_6$. Isohydromellitic acid, $C_{12}H_{12}O_{12}$. Action of sulphuric acid and heat upon isohydromellitic acid. Action of bromine upon hydromellitic acid. Benzolcarbon acids. Hydrobenzol-carbon acids. It should be mentioned that this paper is only the first part of the author's essay on this subject.

Indol.—M. Baeyer.—Indol can be obtained from indigo by two different methods—viz., by causing the vapours of oxindol to pass over heated powdered zinc; or, also, by heating, with the same metal, the yellow material obtained when indigo-blue is treated with tin and hydrochloric acid. From the author's statement, it appears, however, that indol is a substance which is difficultly prepared and very difficult to obtain in pure state. When pure, indol is a solid substance, soluble in water, crystallisable, fusing at 52°, and readily soluble in alcohol, ether, and hydrocarbons; it is a weak base, not forming salts very readily. Composition, in 100 parts:—C, 82·05; H, 5·98; N, 11·97. Formula, C_8H_7N. Indol is characterised by the peculiarity of producing red-coloured combinations. When the alcoholic solution of indol is mixed with hydrochloric acid, it tinges a piece of fir-wood placed therein cherry-red in a few minutes. The author states that

M. Kühne has found indol in the products of decomposition of the pancreatic juice.

New Method of Formation of Monobromacetic Acid.—Dr. Gloeckner.—The author describes, in this essay, a series of experiments made with bromethylen-bromide, $C_2H_2Br_2$, and obtained, especially by treating this substance in sealed tubes exposed to a higher temperature, and containing various substances (as, for instance, BaO, KaO, and water) along with the bromethylen-bromide, among other products, monobromacetic acid.

Action of the Haloids upon the Metallic Derivatives of some Carbon Compounds.—M. Bunge.—The author prepared silver succinimide by boiling pure succinimide with water and oxide of silver. The silver succinimide thus obtained was treated with iodine, and, by means of many carefully executed operations, crystals of pure iodide of succinimide were obtained. This compound is very prone to decomposition, especially when heated, since it cannot bear 100° without very perceptible alteration; it is readily soluble in aceton and water, but difficultly in alcohol and ether. The author obtained, with difficulty, some other compounds, but not in state of sufficient purity for analysis, and failed to substitute cyanogen for the atom of nitrogen which is combined with H in succinimide. Some experiments were also made relating to the action of vapours of bromine upon dried benzoate, oxalate, and succinate of silver; the products hereby obtained are bromobenzoic acid, bromide of silver, and succinic acid.

Zeitschrift für Chemie von Beilstein, No. 22, 1869.

The number contains the following original papers:—

On Cytisin.—Dr. A. Husemann.—This paper contains the account of some additional experiments on this subject, which was briefly abstracted by us from another paper (see CHEMICAL NEWS, vol. xx., p. 36). The formula of cytisin is $C_{20}H_{27}N_3O$; it fuses at 154·5°, and can be sublimed when the heat is properly regulated. The nitrate of this base, $C_{20}H_{27}N_3O,(HNO_3)_3+2H_2O$, is the only salt which crystallises well; it is soluble in water and dilute alcohol; its taste is far more bitter than that of the base itself. The hydrochlorate of cytisin, $C_{20}H_{27}N_3O,4HCl+3H_2O$, is a salt very soluble in water. With the following acids, cytisin yields deliquescent salts:—Sulphuric, phosphoric, formic, acetic, propionic, butyric, valerianic, oxalic, and tartaric. With the chlorides of platinum, gold, and mercury (bichloride), cytisin yields double salts, which can be obtained in crystalline state. Among the large number of reactions discovered by the author for the easy detection of this base, the most sensitive are:—A solution of iodine in iodide of potassium produces, even in the most dilute solutions of cytisin, a deep red-brown precipitate, which is at first amorphous, but becomes, when left standing, converted into beautiful transparent deep-red prisms. Bromine water produces, even in solutions containing only 1-150000th part of the base, a distinct cloudiness, and in more concentrated solutions, an orange-coloured precipitate. Chlorine water does not yield any precipitate or cloudiness at all. Cytisin is found in all parts of the well-known tree, *Cytisus laburnum, L.*, except in the wood; the ripe seeds contain a large quantity of this very dangerous substance, which is a poison, whether it be ingested into the alimentary apparatus or subcutaneously applied. From 3 to 5 decigrms. of cytisin, subcutaneously applied, will kill a large dog within half an hour.

On Isomeric Chlorotoluidines.—M. Wroblevsky.—When pure chlorotoluol is gradually treated with nitric acid (sp. gr., 1·475), the author succeeded in obtaining, after having twenty-six times repeated a fractional distillation, two nitro products, one of which boils at 243°, and the other at 253°; the sp. gr. of the former was found to be 1·307, and of the latter 1·325, both at 18°. The product boiling at 243° is designated by α, the product boiling at 253° by β; the formulæ are—α, $C_7H_6Cl(NO_2)$; β, $C_7H_6Cl(NO_2)$. Both bodies having been treated with fuming sulphuric acid, yield a sulpho acid; the baryta salt of that acid of the α kind is a readily crystallisable salt, rather difficultly soluble in water—formula, $(C_7H_5ClNO_2.SO_3)_2Ba+4H_2O$; the baryta salt of the β kind is so readily soluble in water that it is impossible to obtain it in pure state. α chlorotoluidine, obtained from α $C_7H_6Cl(NO_2)$, by the action of Sn and HCl, is a fluid, sp. gr. at 20°, 1·185, boils at 238°, is not solidified at −14°, insoluble in water, and readily soluble in alcohol; β chlorotoluidine is a solid (when pure), crystallising in large foliated crystals, fuses at 38°, boils at 241°, almost insoluble in water, and readily soluble in alcohol. Both these substances yield crystallisable salts.

Contribution to the Knowledge of Sulpho-Nitrogen Acids (Schwefelstickstoffsäuren).—MM. Claus and Koch.—When neutral aqueous solutions of nitrite of potassa and sulphate of potassa are mixed together, there will be at first formed a cloudiness, or turbidity, shortly followed by the appearance of a quantity of needle-shaped crystals, while the solution becomes, simultaneously, distinctly alkaline to test paper. If concentrated solutions of the salts referred to are mixed, the reaction is finished in a couple of minutes, and the mass has become a thick magma, while, at the same time, the temperature of the mixture sometimes rises to 80°. The authors have investigated this salt, and studied many of its derivatives; the salt alluded to, tetrasulphammoniate of potassa (*tetrasulfammonsaures-kali*)—

$$K_4HNS_4O_{12}+3H_2O=4\left(S\begin{matrix}OK\\O_2\end{matrix}\right)^1\}.NH,$$

is formed according to the following equation:—

$$4(K_2SO_3)+KNO_2+3(H_2O)=5(KHO)+K_4HNS_4O_{12}.$$

The authors describe, at length, the mode of preparation and analysis of trisulphammoniate of potassa—

$$3\left(S\begin{matrix}OK\\O_2\end{matrix}\right).NH_2,$$

obtained from the foregoing salt by the action of water upon it according to the formula—

$$4\left(S\begin{matrix}OK\\O_2\end{matrix}\right).NH+H_2O=3\left(S\begin{matrix}OK\\O_2\end{matrix}\right).NH_2+KHSO_4,$$

of a disulphammoniate of potassa—

$$3\left(S\begin{matrix}OK\\O_2\end{matrix}\right).NH_2+H_2O=2\left(S\begin{matrix}OK\\O_2\end{matrix}\right).NH_2+KHSO_4.$$

The preparation and mode of analysis of these salts require very delicate manipulation.

Chemical Constitution of Pyroxiline (Gun Cotton).—Dr. Gintl.—The author states that when gun cotton, and also the collodion wool, are thoroughly moistened with concentrated sulphuric acid, after having been previously washed with water, so as to remove any matters present therein soluble in water, and left quietly standing in a well-closed suitable vessel, the substances will be dissolved and converted into a colourless, syrupy fluid. When this fluid is cautiously diluted with water, so as to prevent any increase of temperature, and next saturated with carbonate of baryta, and the excess of the latter salt, along with the sulphate of that base, are removed by filtration, there is obtained a perfectly colourless fluid, which, after having been evaporated *in vacuo* over sulphuric acid, leaves a gum-like mass, containing crystals of nitrate of baryta. The gum-like matter consists chiefly of the baryta salt of ligno-sulphuric acid (*holzschwefelsäure*), which may be obtained in free state by very cautious and careful removal of the baryta, by means of dilute sulphuric acid. Ligno-sulphuric acid was first discovered by Braconnot.

NOTES AND QUERIES.

Electrotyping Cast-Iron with Brass.—Can any of your readers kindly inform me if there is any known method of electrotyping cast-iron with brass?—E. B.

Dissolving Resin in Water.—Will any of your readers kindly inform me whether there is any process by which ordinary resin can be dissolved in water without losing its clearness and natural orange colour; and, if so, what the process is?—J. MILTON.

Analysis of Nitrous Oxide.—(Reply to "Veritas.")—Happening to possess a copy of Roscoe's "Elementary Chemistry," and looking over the article "Nitrous Oxide," I find he does not assert that, after analysis of the gas by potassium, in a bent tube over mercury, the products, after combustion of the metal in the gas, are nitrogen and potassium hydroxide, KHO; but he says that the products of the combustion are solid potassium oxide, or potash, and nitrogen.—W. K.

Native Carbonate of Baryta.—Will any of your readers kindly inform me, through the medium of your valuable paper, what are the principal applications of native carbonate of baryta, and what is about its market value?—A READER.

[Commercial value, according to purity, from 8s. to 9s. 6d. per cwt. Is applied for the manufacture of salts of baryta, for the preparation of caustic baryta, and also in glass-making.]

MEETINGS FOR THE WEEK.

MONDAY, Jan. 3rd.—Medical, 8.

TUESDAY, 4th.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

WEDNESDAY, 5th.—Pharmaceutical, 8.

THURSDAY, 6th.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

—— Royal, 8.30

—— Royal Society Club, 6.

FRIDAY, 7th.—Geologists' Association (Anniversary), 7.30.

SATURDAY, 8th, 1870.—Royal Institution, 3. Prof. Tyndall, "On Light." (Juvenile Lectures).

TO CORRESPONDENTS.

*** *Owing to our weekly Enclycopœdic List of Foreign Papers connected with Chemistry and Physical Science having so materially enlarged the Contents of the* CHEMICAL NEWS, *we are compelled to issue the Index as a Supplementary Number. It has been compiled with great care, and with our copious abstracts of all the important papers, may be said to form an English edition of the "Jahresberichte." With the commencement of our new volume we intend to improve the appearance of the* CHEMICAL NEWS *by printing it on paper of a much better tone and quality.*

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